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EXPERIMENTS

AND

OBSERVATIONS,

IN

THREE PARTS.

PART I. On the Diſſolvent Power of Water Impregnated with Fixible Air, compared with Simple Water, relative to Medicinal Subſtances.

PART II. On the Diſſolvent Power of Water Impregnated with Fixible Air, on the Urinary Calculus.

PART III. On the Antiſeptic Power of Water Impregnated with Fixible Air, and a Compariſon of ſeveral Antiſeptic Subſtances with one another relative to this Quality.

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TO

DR. PRIESTLEY

THESE EXPERIMENTS

ARE INSCRIBED,

As a ſmall Acknowledgment of his high

Merit in this Branch of Science,

BY

His moſt obedient ſervant,

WILLIAM FALCONER.

EXPERIMENTS

On the DISSOLVENT POWER of

FIXIBLE AIR.

AT the preſent period, when the qualities of aërial bodies, and fixible air in particular, are ſo much the ſubject of enquiry, it ſeems remarkable, that one of the properties of the laſt-mentioned ſubſtance, which is to appearance not inobvious, ſhould have been ſo long overlooked by Philoſophers of ſuch note as have made that ſubſtance the object of their inveſtigation. I mean its quality of rendering ſeveral bodies ſoluble in, or at leaſt miſcible with water, that were not ſo in their uſual form.

I do not however myſelf pretend to aſſume the merit of this diſcovery, if it be one, in any reſpect or degree whatever, but frankly own, that it was ſuggeſted to me by my ingenious friend Dr. Nooth, whoſe abilities in this branch of knowledge, and many others relative to medicine, I can ſcarce ſufficiently commend. He mentioned to me, in the autumn of the year 1774, when he was for ſome time at this place for the recovery of his health, that he had found water impregnated with fixible air to prove a powerful menſtruum for ſeveral ſubſtances which were not of themſelves ſoluble in ſimple water. Among others he mentioned camphor and ſulphur, and in a few days he ſhewed me the experiment relative to the firſt of theſe ſubſtances, which plainly proved, that water impregnated with fixible air might receive a ſtrong impregnation alſo from camphor, by ſimple infuſion only. He likewiſe informed me, that he had tried the ſame experiment alſo with ſulphur, which he had found diſſolved in the ſame manner. Soon after we tried the ſame experiment with myrrh, and found that ſubſtance to be ſoluble in no inconſiderable quantity in water thus impregnated. Theſe circumſtances encouraged me to hope, that the knowledge of theſe qualities of fixible air might prove a conſiderable acquiſition to the ſcience of medicine, as there are many bodies whoſe efficacy we have reaſon to think would be very great on the human body, if they could be adminiſtered in a form which would be likely to give them opportunity to exert their powers. Many of our moſt potent remedies alſo are ſo much limited in their doſe, by the quality of the menſtruum or ſubſtance that holds them diſſolved, which is often vinous ſpirits, that we cannot employ them in quantity ſufficient to obtain their efficacious qualities. A ſolution of theſe ſubſtances in water, or water impregnated with fixible air, would lie under no objection with reſpect to the quality of the menſtruum or vehicle, if it could be procured of ſufficient ſtrength to be active in ſuch a doſe as would not be objectionable in point of bulk or quantity. This fixible air ſeemed to promiſe, by the ſpecimens which I had ſeen of its power in this way, and I really hoped and expected my ingenious and learned friend before-mentioned would have favoured the world with his ſentiments and experiments on that ſubject before this time. But as he has been, I preſume, otherwiſe engaged, and is now abroad in the ſervice of the publick, I have ventured to communicate to the world my opinions on the ſame ſubject, and to relate the events of the experiments I have myſelf made, which are all with a view to medicine.

The firſt diviſion of them is of thoſe that refer to the ſolubility of medicinal ſubſtances in water impregnated with fixible air, and a compariſon of its efficacy in this way with ſimple water, in which tho' I have in part ſucceeded, I muſt confeſs I have been much diſappointed in my own expectations, relative to the diſſolving power of water thus impregnated. But it is equally important to the public, to receive information as to the inefficacy as well as the efficacy of any ſubſtances relative to medicine, and eſpecially thoſe concerning which great expectations have been formed.

To theſe I have added a few experiments on the diſſolving power of water thus impregnated on the urinary calculi, according to the theory of Dr. Percival, and am happy to be able to inform the public, that I have been more fortunate in this inſtance; and that water thus impregnated bids fair to prove an effectual and not a ſlow remedy in this tormenting and tedious complaint. My experiments on this ſubject are, I confeſs, but few; but they are accurate, and related without any attachment to theory or ſyſtem, but only intended to throw light on the real efficacy of the propoſed remedy.

I HAVE laſtly added ſome experiments on fixible air, as an antiſeptic, compared with other ſubſtances that have been remarkable for that quality; and the importance of this in a medical light is too obvious to be noticed.

I PROPOSE, if I have health and leiſure, to enlarge the ſphere of theſe experiments as far as they concern medicine, and particularly relative to the effects of fixible air in promoting or diminiſhing the power of ſpirituous menſtruums, and as to their effects as antiſeptics likewiſe. But this muſt be the ſubject of future conſideration.

SALINE BODIES.

Saline bodies are in general ſoluble in water, but ſome of them are ſo ſparingly diſſolved as to limit their doſe greatly by that means. Sal Succini is one of theſe, on whoſe efficacy much ſtreſs was formerly laid, and even at preſent it is in conſiderable eſteem with ſome modern practitioners.—To improve the diſſolving quality of water in this reſpect would be very deſirable, and the following experiments for that purpoſe were made with water impregnated with fixible air, and compared with diſtilled water.

Sal. Succini.

Exp. I. Twenty-five grains of ſal ſuccini powdered were added to ℥ii of diſtilled water ſtrongly impregnated with fixible air, and ſhaken well, and ſuffered to ſtand twelve hours, and the like quantity to ℥ii of ſimple diſtilled water, which was treated in the manner above-mentioned. Both of them had acquired a conſiderable degree of acidity to the taſte, and a light yellow colour, but I could not perceive which of the two poſſeſſed either of theſe qualities in the greateſt degree; the greateſt part of the ſalt remained undiſſolved in each after ſtanding four days, and had by that time acquired on its ſurface a brown flocculous appearance.

Exp. II. Fifteen drops of the ſolution of ſal ſuccini with fixible air, and the like quanlity of the ſolution in ſimple diſtilled water, were added each ſeparately to ℥i of diſtilled water, and into each put twelve drops of a ſtrong ſolution of lacmus in water. Both were turned red by it; but that with fixible air ſhewed rather the deeper colour.*

Flor. Benzoin.

Flowers of Benzoin are another ſaline ſubſtance of exceeding difficult ſolubility in water; and though their virtues as medicines may have been formerly over-rated, yet it is not improbable that the modern opinion of their inefficacy may be in ſome meaſure owing to their not being exhibited in a form capable of ſuffering them to exert their effects, as they are poſſeſſed of a fine aromatic flavour, and a pungent though not diſagreeable ſaline taſte.

Exp. III. Twenty-five grains of Flowers of Benzoin were added to ℥ii of ſimple diſtilled water, and a like quantity to ℥ii of diſtilled water impregnated with fixible air. After ſtanding twenty-four hours they were examined: The flowers in the firſt had moſtly ſunk to the bottom, and in thelatter nearly all floated on the top; and this happened ſeveral times after being repeatedly ſhaken up.——

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* Fixible air changes ſolution of lacmus red, but the quantity of water thus impregnated was too ſmall to have any ſenſible effects here. Fifteen drops of water ſtrongly impregnated with fixible air had no effect on a like quantity of water and ſolution of lacmus.

The water was then filtred from each. Both had acquired an acid taſte and ſmell of the gum itſelf, but that with the fixible air was much the moſt perceptible.

Exp. IV. Forty drops of the infuſion of flor. Benzoin in water impregnated with fixible air gave an evident reddiſh caſt to ℥i of diſtilled water with twelve drops of ſolution of lacmus, whilſt that in ſimple diſtilled water had no effect in altering the colour.

Forty drops of diſtilled water impregnated with fixible air had no effect on the colour of a ſimilar quantity of diſtilled water and ſolution of lacmus.

Fixible air in both theſe inſtances ſeems to have increaſed the diſſolving power of ſimple diſtilled water, but its effects are ſcarce conſiderable enough in theſe inſtances to be of any great importance to medicine. Moſt of the other ſaline ſubſtances, properly ſo called, are ſufficiently ſoluble of themſelves in ſimple water to anſwer the intention propoſed.—Sedative ſalt, or the acid ſalt of borax, is however an exception, and what I wiſhed to have tried; but I could not meet with any that I could depend upon for genuine.

Some of the metallic ſalts are of difficult ſolubility in water, and are ſaid likewiſe to be apt to be precipitated again from the menſtruum, which renders the doſe unequal and uncertain; a circumſtance of the greateſt conſequence to be attended to in practice.

Corroſive Sublimate.

Corrosive ſublimate is of this kind, which is of ſlow and ſparing ſolubility in common water, and apt to ſeparate again from its menſtruum. But I am inclined to ſuſpect the laſt-mentioned circumſtance to be owing to the impurity of the water generally employed, as I find that no ſuch precipitation happens after ſeveral weeks keeping, when diſtilled water is uſed.

Exp. V. Ten grains of corroſive ſublimate were added to two ounces of diſtilled water, and the ſame quantity to two ounces of diſtilled water impregnated with fixible air. That in the fixible air was nearly diſſolved in about 12 hours; the other had not above one-third diſſolved in that time; but in the ſpace of three days the whole of the ſublimate was compleatly diſſolved in each of them, and gave not the leaſt ſigns of precipitation in either after ſtanding a week.—As a ſolution of this degree of ſtrength is fully ſufficient for every internal purpoſe, this ſimple mode of exhibition in diſtilled water ſeems preferable either to the common method of giving a ſolution of it in ſpirits, which it is well known are apt to depoſite the ſublimate by ſtanding, or to the mixing a few grains of crude ſal ammoniac with the water uſed, which indeed enables the latter to diſſolve the ſublimate much more ſpeedily, and likewiſe hinders any ſubſequent precipitation; but at the ſame time it probably cauſes a decompoſition of the ſublimate.—The principal inconvenience is, that the ſublimate is of ſo ſlow ſolution, which makes it improper when the ſolution is directed in extemporaneous preſcriptions; but this may be either aſſiſted by heat, or a ſolution ready made of the ſtrength above-mentioned may be kept in the ſhops as an officinal preparation, for which it is well ſuited, it not ſuffering any precipitation or alteration in its qualities by keeping.

Calomel.

Calomel is likewiſe accounted altogether inſoluble in water. Its ſolubility in that menſtruum would be a very deſirable thing, as the doſe would be eaſier meaſured; a circumſtance of conſiderable conſequence, as it is ſo often adminiſtered to infants; and likewiſe we ſhould be more certain of its being exhibited than in its preſent form, as its great ſpecific gravity makes it ſo apt to ſubſide in liquids, which is the uſual form of giving medicines to young children.—Water impregnated with fixible air was tried for this purpoſe, and diſtilled water, but both without ſucceſs, as appears by the following experiment:

Exp. VI. Ten grains of calomel were added to two ounces of diſtilled water, and a like quantity to two ounces of diſtilled water impregnated with fixible air. After ſtanding four days, I examined them: The calomel did not appear to be diſſolved in either in the ſmalleſt degree, nor did any precipitation happen on adding to each of the waters ſeveral drops of a ſolution of Hepar Sulphuris in diſtilled water.

Emetic Tartar.

Emetic Tartar is likewiſe a ſubſtance of difficult ſolubility, which makes it ſometimes inconvenient with reſpect to the uncertainty of the doſe, in a medicine of ſuch conſequence, and on which ſo great dependence is often had to produce an almoſt immediate effect. Fixible air united with water was tried to increaſe its ſolubility, but, as will appear by the experiment, without effect.

Exp. VII. Twenty grains of Emetic Tartar were added to ℥ii of diſtilled water impregnated with fixible air, and the like quantity to ℥ii of ſimple diſtilled water, and both vials ſhaken up and ſet to ſtand. After ſtanding three days, the ſimple diſtilled water had diſſolved about four-fifths of the Emetic Tartar, whilſt the other with fixible air had not diſſolved above one-third.

Salt of Steel.

Salt of Steel is likewiſe a ſubſtance which, though ſufficiently eaſy of ſolution, is apt to precipitate again from the menſtruum by keeping, which makes it appear diſagreeable to the eye, and uncertain in its doſe in medicine. A ſmall quantity of the vitriolic acid is generally uſed on that account, which keeps the iron ſuſpended, and the ſolution clear. I found fixible air to have nearly the ſame effect, as will appear by the following experiment:

Exp. VIII. One drachm of Salt of Steel was added to ℥ii of ſimple diſtilled water, and a like quantity to ℥ii of diſtilled water impregnated with fixible air. In about 24 hours the whole was diſſolved in each of them. After ſtanding five days, that in the ſimple diſtilled water had depoſited a large ochrous ſediment, and was grown muddy: The other remained perfectly clear, and had let fall ſcarce any precipitation.

INFLAMMABLE BODIES.

Oily Bodies, expreſſed oils particularly, are well known to be by themſelves immiſcible with water. To try if they could be rendered capable of being united with water, by means of fixible air, the following experiment was made:

Olive Oil.

Exp. IX. Thirty drops of olive oil were put into two ounces of diſtilled water impregnated with fixible air and ſtrongly ſhaken. But after ſtanding a week, not the leaſt union appeared to have taken place,—the oil and water continuing perfectly diſtinct as at their firſt admixture.

As fixible air appears to be of the nature of an acid, it ſhould ſeem probable that it ſhould, like acids, ſeparate oil from water, when united by the mediation of an alkali. There is more reaſon to think that this would be the caſe with fixible air, as it is well known that it is requiſite to have the alkali in its moſt cauſtic ſtate, or moſt devoid of fixible air, in order to form a ſoap: But altho' fixible air, when previouſly united with an alkali, prevents its union with oil, it does not ſeparate them again when once they are united, as the following experiment ſhews:

Soap.

Exp. X. Twenty grains of white ſoap ſhaved were added to ℥ii of ſimple diſtilled water, and to the like quantity of diſtilled water impregnated with fixible air. I agitated both the phials frequently, and in a few minutes the ſoap was in a good meaſure diſſolved in both. Not the leaſt ſeparation of the oil took place in either of them, and the mixture ſeemed full as complete (being whiter and more opake) in the water impregnated with fixible air, as in the other.

Oil

Oil of Almonds in form of Emulſion.

Nor has fixible air the power of ſeparating oils from water when united to it by means of farinaceous ſubſtances, as in the form of emulſion.

Exp. XI. Six ounces of an emulſion * made with ſimple diſtilled water and almonds, with a little white ſugar, were expoſed for above an hour to a ſtream of fixible air in one of Dr. Nooth's machines, and ſtrongly impregnated with it. No ſeparation of the oil, or change in the appearance of the emulſion, happened during the operation, nor did the oil ſeparate from it on ſtanding ſooner than it did from another portion which was not expoſed to the fixible air.

ESSENTIAL OILS.

From the experiments I had ſeen upon camphor, I had reaſon to believe that water impregnated with fixible air might have conſiderable efficacy in diſſolving eſſential oils; but I was in a great meaſure diſappointed in this expectation, as will appear from the following experiments:

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* This emulſion was made without Gum Arabic on purpoſe, becauſe that ſubſtance has the property of rendering oils ſoluble in water without their being ſeparated by acids.

Oil of Turpentine.

Exp. XII. Thirty drops of ætherial oil of turpentine were mixed with two ounces of water impregnated with fixible air: but after ſtanding together ſeveral days, not the leaſt union appeared to have taken place; I had however rather better ſucceſs with another eſſential oil, viz.

Eſſence of Lemons.

Exp. XIII. Ten drops of eſſence of lemons were added to ℥ii of diſtilled water, and the ſame quantity to ℥ii of diſtilled water impregnated with fixible air, and ſhaken. After ſtanding five days, that in the diſtilled water floated ſeparate on the ſurface, while that in the water impregnated with fixible air had diſappeared and was diffuſed through or diſſolved in the water, as appeared from its ſtrong taſte and ſmell.

Fixible Air does not appear to have any power of diſſolving ſome at leaſt of the eſſenſial oils when mechanically diffuſed through water, as is the caſe in diſtillation.

Caſſia

Caſſia Bud Water.

Exp. XIII. Six ounces of a ſimple water diſtilled from the buds of the Caſſia officinalis, which much reſembles that of cinnamon in taſte and ſmell, and is of a milky colour, were expoſed to the ſtreams of fixible air in Dr. Nooth's machine for above an hour: But the fixible air, though it was quickly imbibed and imparted a ſtrong taſte to the water, had yet no effect either in diſſolving the diffuſed oil or in ſeparating it from the water.

Simple Peppermint Water.

Exp. XIV. Six ounces of ſimple Peppermint water, very milky and ſtrong, were in like manner expoſed to the ſtreams of fixible air without any ſenſible effect, though the air was largely imbibed by the liqour.

BALSAMS.

I next made trial of ſome reſinous ſubſtances, as balſams, which approach in their nature very near to eſſential oils, but was diſappointed in theſe inſtances, as will appear by the following experiments:

Balſam af Peru.

Exp. XV. Twenty drops of balſam of Peru were added to ℥ii of ſimple diſtilled water, and the like quantity to ℥ii of diſtilled water impregnated with fixible air, and ſuffered to ſtand ten days. The water in each had gained a ſlight degree of flavour from the balſam, and nearly equal in both; but had no other ſigns of ſolution, being both quite clear and colourleſs, and the balſam remaining at the bottom of the phial without any ſigns of ſolution.

Balſam of Tolu.

Exp. XVI. The above experiment was tried with 20 grs. of Balſam of Tolu. The water here in both had acquired a ſlight ſmell of the balſam, but had no taſte of it, nor was the colour altered in either.

Balſam of Capivi.

Exp. XVII. I tried the ſame experiment with Balſam of Capivi; but neither the ſimple diſtilled water, nor that impregnated with fixible air, gave the leaſt ſigns of diſſolving the balſam.

Camphor.

Camphor has been generally eſteemed of the ſame kind with eſſential oils, as it poſſeſſes moſt of their diſtinguiſhing properties. Of the ſolubility of this in water, by means of fixible air, I have before ſpoken, and have frequently tried ſince I was firſt ſhewn it by Dr. Nooth. But on the preſent occaſion I made the following comparative experiment:

Exp. XVIII. Thirty grains of camphor were put into ſix ounces of ſimple diſtilled water, in a phial, and the like quantity into ſix ounces of water impregnated with fixible air, a continued ſtream of which was driven through the water after the camphor was put in, during the ſpace of above two hours. It was then put into a phial, and corked up at the ſame time with the mixture of the camphor with ſimple diſtilled water, and ſuffered to ſtand 24 hours. I then ſtrained them both through a hair ſieve, and ſeparated the camphor from each, which, after being to appearance moderately dried, I weighed again, and to my great ſurprize, found it ſcarce perceptibly different from what it was in each of them when put in. Both the ſimple diſtilled water, and that impregnated with fixible air, had however acquired a ſtrong taſte of the camphor; but that with the fixible air was conſiderably the ſtrongeſt, both in ſmell and taſte.—I weighed the camphor the next day, which was taken out of the waters reſpectively, after having lain 24 hours in the window of a room, about 56 deg. of heat, and on ſoft paper to abſorb the moiſture. That which had been in the ſimple diſtilled water had loſt ſix grains of its original weight, and the other ſeven grains, but probably much the greater part of this was loſt by exhalation after the camphor was taken out of the water.

I have often obſerved the particles of camphor, during their diſſolution in water impregnated with fixible air, to be turned round with a quick rotatory motion. But this appearance is not conſtant, nor did I obſerve it in the experiment here related.

This experiment proves, that both the ſmell and the taſte of camphor are extremely diffuſible. The quantity here diſſolved was probably extremely ſmall, yet the ſmell and taſte were very ſtrongly diffuſed through ſix ounces of water. And this ſeems a convenient way of exhibiting camphor, and affording a fair trial of its effects. The quantity diſſolved, it muſt be allowed, is probably very ſmall; but at the ſame time a ſolution of this kind is much ſtronger than the Camphor Julep of the ſhops. I look upon the general inefficacy of this drug to be owing in a great meaſure to its being given in a manner wherein very little is diſſolved. It is certainly true, that a ſmall quantity will ſometimes have great effects. Dr. ALEXANDER, who ſwallowed a large doſe of it, found it when rejected by vomit ſcarce, if at all, diſſolved or diminiſhed in quantity; ſo that the quantity that really affected him ſo violently as he relates, muſt have been exceſſively little. Sir JOHN PRINGLE likewiſe found Camphor to be highly antiſeptic in an almoſt inconceivably ſmall quantity.

GUM RESINS.

Several medicinal ſubſtances are compounded of a gummy and reſinous matter, intimately united, by which they become ſoluble in ſome meaſure both in water and ſpirits. Theſe ſolutions are however but imperfect; the ſpirit diſſolving the reſinous part chiefly, and the water the gummy; though by the mediation of the reſin, ſome gum is diſſolved by the ſpirit, and by that of the gum ſome reſin in the water. A watery menſtruum that would diſſolve both uniformly and compleatly, would be very deſirable, not only as affording the virtue of the ſubſtance complete, but alſo on account of the nature of the menſtruum, which is leſs objectionable than ſpirits. With this view I made the following experiments, which, I am ſorry to ſay, did not anſwer my expectations:

Socotorine Aloes.

Exp. XIX. Twenty grains of Socotorine Aloes in powder were added to two ounces of diſtilled water, and to two ounces of diſtilled water impregnated with fixible air. After ſtanding ſix days, that in the ſimple diſtilled water had imparted a deep reddiſh brown colour and ſtrong taſte of the ſubſtance; that in the water impregnated with fixible air was much weaker in colour, ſmell, and taſte.

Myrrh.

Myrrh likewiſe is in ſome meaſure of the ſame nature with Aloes. This ſubſtance was in high repute with the old phyſicians and chemiſts; and a complete watery ſolution of it was one of the Deſiderata of Van Helmont, who attributed to it great effects in prolonging life, which even BOERHAAVE, from obſervation of its antiſeptic qualities, thought to be an opinion not deſtitute of foundation. Modern practice, however, pays little regard to it with reſpect to ſuch extraordinary effects, but at the ſame time it is frequently employed and eſteemed by many practitioners, perhaps not undeſervedly, as a warm corroborant deobſtruent and antiſeptic medicine. As it is very ſoluble in water, I tried the effect of fixible air, but without ſucceſs.

EXP. XX. Twenty grains of Myrrh in powder were added to ℥ii of diſtilled water, and a like quantity to ℥ii of water impregnated with fixible air; after ſtanding a week, both had acquired a pale yellow colour; but that with the fixible air was very perceptibly the paler of the two, and was likewiſe weaker both in ſmell and taſte.

Gum Ammoniacum.

GUM AMMONIAC is rather more eaſy of ſolution in water than Myrrh, yet in every watery preparation of it, as in the *Lac Ammoniaci*, a conſiderable proportion of it is almoſt always left undiſſolved. As it is now in very common uſe as an antiſpaſmodic, and given often in caſes that require the moſt immediate aſſiſtance, a ſtrong watery ſolution of it would be very deſirable. For this purpoſe I made trial of fixible air, but without ſucceſs.

Exp. XXI. Thirty grains of Gum Ammoniac in powder were added to two ounces of ſimple diſtilled water, and to two ounces of water ſtrongly impregnated with fixible air, and each ſtrongly agitated. The phial with the fixible air was not of ſo white a colour as that with diſtilled water, nor ſo ſtrong a taſte of the gums. After ſtanding four days, the phial with the fixible air was but ſlightly milky, whereas the other was ſtill ſo much ſo as to be nearly opake.

Opium.

The importance of a complete watery menſtruum for Opium would be very great, could it be procured. Fixible air was tried, but, as it will appear, without ſucceſs.

Exp. XXII. Twenty grains of the Thebaic Extract, ſliced thin, were put into two ounces of ſimple diſtilled water, and the like quantity to two ounces of diſtilled water impregnated with fixible air, after ſtanding a week, both of them had acquired a yellow colour, and were perfectly clear; but I could not diſcern in which the tinge was the deepeſt. The taſte and ſmell likewiſe were as near as could be judged equally ſtrong in both, and conſiderably leſs diſagreeable than the common tinctura thebaica.

ANIMAL ESSENTIAL OILS.

I next made trial of the ſolvent powers of water impregnated with fixible air on ſome of the animal eſſential oils, but without ſucceſs.

Muſk.

EXP. XXIII. Ten grains of Muſk were put into two ounces of diſtilled water, and an equal quantity into two ounces of diſtilled water impregnated with fixible air. After ſtanding a week, that in the ſimple diſtilled water had acquired a dark brown colour, and the ſolution taſted and ſmelt very ſtrong of the muſk; that in the water impregnated with fixible air was much paler in colour, and weaker both in ſmell and taſte.

Caſtor.

Exp. XXIV. One ſcruple of caſtor was added to two ounces of ſimple water, and the ſame quantity to two ounces of water impregnated with fixible air. After ſtanding a week, both had acquired a faint yellowiſh brown colour, and a ſlight taſte of the caſtor; but I could not perceive in which either of theſe were moſt predominant.

SENSIBLE QUALITIES *of* VEGETABLES.

I next made trial of the power of water impregnated with fixible air, in extracting ſome of the other qualities of vegetables, but I did not meet with any great ſucceſs in this inquiry.

BITTERS.

I tried it firſt upon bitters, of which I took gentian root as a ſpecimen, as being one of the pureſt bitters we are acquainted with.

Gentian.

Exp. XXV. A drachm of gentian root in powder was added to ℥ii of ſimple diſtilled water, and a like quantity to two ounces of diſtilled water impregnated with fixible air. In a week's time both the ſolutions had acquired a beautiful browniſh red colour; but the ſimple diſtilled water was rather the deeper of the two, and ſtronger likewiſe in taſte of the gentian.

VEGETABLE ASTRINGENTS.

I next tried the effect of water impregnated with fixible air on the vegetable aſtringents, of which I took oak galls as a ſpecimen.

Oak Galls.

EXP. XXVI. One drachm of powdered oak galls was added to ℥ii of ſimple diſtilled water, and the like quantity to ℥ii of water impregnated with fixible air. After ſtanding a week, both had acquired a reddiſh brown colour, but I could not determine in which it was the deepeſt.

EXP. XXVII. Into four ounces of diſtilled water were dropped twenty drops of ſolution of ſalt of ſteel in diſtilled water, and then the water thus impregnated was divided into two glaſſes, each containing ℥ii. Into one of theſe

I dropped ten drops of the ſolution of galls in ſimple diſtilled water, and into the other the ſame quantity of the ſolution of galls in diſtilled wated impregnated with fixible air. No change of colour was produced in either for ſome minutes; but at laſt that with the ſolution of galls in ſimple diſtilled water began to change to a purpliſh hue, and grew gradually deeper, until in about a quarter of an hour it became a deep purple. The other began to change in a few minutes after the firſt, and became gradually darker, but never arrived to the degree of the firſt, being ſeveral ſhades lighter.

Was this difference owing to the water impregnated with fixible air being a leſs perfect ſolvent for the galls than ſimple water, or to the fixible air in the ſolution of galls tending to keep the iron in ſolution, and preventing its precipitation by the aſtringent? The former ſuppoſition is much more probable, as the quantity of fixible air contained in ten drops of the ſolution muſt be extremely ſmall. Acids and aſtringents when combined are ſaid to leſſen mutually each other's efficacy. Perhaps this may be the caſe with aſtringents and fixible air.

Simple water is therefore in all probability a more efficacious ſolvent of the aſtringency of vegetables, than water impregnated with fixible air.

BITTER ASTRINGENTS.

Some vegetable ſubſtances, wherein bitterneſs and aſtringency were combined were, next tried. Among the principal of theſe is the Peruvian bark.

Peruvian Bark.

EXP. XXIX. Two drachms of Peruvian bark powdered were put into ſix ounces of ſimple diſtilled water, and the ſame quantity into ſix ounces of diſtilled water impregnated with fixible air. After ſtanding a week, both of them had acquired a reddiſh yellow tinge, which was as nearly as poſſible equal in both, and a bitter aſtringent taſte; but I could not diſcern in which the laſt of theſe was moſt prevalent.

EXP. XXX. Forty drops of ſolution of ſalt of ſteel in water, were mixed with four ounces of diſtilled water, which was divided into two equal parts. To one was added forty drops of infuſion of the bark in ſimple water, and to the other forty drops of the infuſion of the ſame ſubſtance in water impregnated with fixible air. No change was produced for ſome time; but after ſtanding a few hours, a black cloud, with ſomewhat of a greeniſh caſt, was produced in both; but I could not diſcern in which it was moſt prevalent.

Snake Root. Serpentaria Virginenſis.

Snake root is of this kind, joined with a warm aromatic flavour. The importance of this drug in medicine inclined me to make trial of it in this way:

Exp. XXXI. Two drachms of powdered ſnake root were infuſed in ſix ounces of ſimple diſtilled water, and a like quantity in ſix ounces of water impregnated with fixible air. After ſtanding a week, the ſimple diſtilled water had gained a deep reddiſh brown tinge, and the water impregnated with fixible air a ſimilar one, but lighter. The ſimple diſtilled water likewiſe taſted ſtronger of the ſnake root than the other.

Rhubarb.

Rhubarb is likewiſe poſſeſſed in ſome meaſure of ſimilar ſenſible qualities with the foregoing, having a degree of bitterneſs joined with ſome aſtringency, and an aromatic flavour. A trial was made with it alſo.

Exp. XXXII. One drachm of powdered rhubarb was added to two ounces of ſimple diſtilled water, and a like quantity to two ounces of diſtilled water impregnated with fixible air. After ſtanding a week, both of them had acquired a beautiful deep red colour. The ſimple diſtilled water ſeemed to be the deeper of the two, but the difference was very trifling.

Green Tea.

As green tea poſſeſſes the ſame qualities in ſome meaſure, a trial was made of it likewiſe.

Exp. XXXIII. Half a drachm of fine green tea was added to two ounces of ſimple diſtilled water, and a like quantity to ℥ii of diſtilled water impregnated with fixible air. After ſtanding a week, both the waters had acquired a green colour; but the ſimple diſtilled water was rather the deeper of the two.

Exp. XXXIV. Forty drops of a ſolution of ſalt of ſteel were mixed with four ounces of diſtilled water, which was then divided into two equal parts. To one of theſe I added 40 drops of the infuſion of tea in ſimple diſtilled water, and to the other 40 drops of the infuſion of tea in diſtilled water impregnated with fixible air. No change was produced for ſome time; but on ſtanding about an hour, a purple cloud was formed in both, which in a few hours precipitated, and was as near as could be judged equal in both.

Sulphur.

Sulphur, when pure, has been generally eſteemed to be immiſcible with ſimple water. Fixible air has been reported to render it ſoluble in that fluid. To determine this, the following experiment was made:

Exp. XXXV. Two ſcruples of waſhed flowers of ſulphur were put into eight ounces ſimple diſtilled water, and a like quantity into eight ounces of diſtilled water impregnated with fixible air. After ſtanding a week and being frequently ſhaken, an ounce of water from each was filtered into ſeparate glaſſes, and to each added 20 drops of ſolution of Sacch. Saturni in diſtilled water; but no change was produced in either by the addition, nor had either of the liquors the leaſt ſmell or taſte of ſulphur. Sulphur therefore does not appear to be in the ſmalleſt degree ſoluble either in ſimple water, or in water impregnated with fixible air. On repeating this experiment, I once, by miſtake, inſtead of water put about three ounces of ſpirits of wine to dilute the oil of vitriol, in order to make a greater diſcharge of air. When the water became ſufficiently impregnated, I taſted it, and found it had no taſte of ſulphur, but an odd kind of a ſweetiſh flavour, and very ſtrong of the fixible air. It now precipitated ſolution of Sacch. Saturni very largely, but had ſcarce any effect on ſolution of ſilver. *Q.* Was this owing to the vapour of the ſpirits ariſing with the fixible air, enabling the water to diſſolve the ſulphur?

METALS.

THE ſolubility of metallic ſubſtances in water impregnated with fixible air, is a circumſtance of conſiderable importance both in medicine and in the common occurrences of life; in the former, as water thus impregnated might prove a convenient vehicle for their being adminiſtered; and in the latter, as the impregnation of water with fixible air is a common incident in ſprings, leſt ſuch water might corrode the veſſels uſed in the preparation of our food, and thus impart a metallic impregnation where it was leaſt deſired, and perhaps too of a dangerous quality.

Iron.

IRON is well known to be ſoluble in water impregnated with fixible air, from the experiments related by the ingenious Mr. LANE, in the Philoſophical Tranſactions. To throw farther light on this ſubject, the following experiments were made:

EXP. XXXVI. Half a drachm of iron filings was put into ℥ii of ſimple diſtilled water, and a like quantity to ℥ii of diſtilled water impregnated with fixible air. After ſtanding about a fortnight, the ſimple diſtilled water had depoſited a ſmall quantity of a browniſh ochery ſediment; the other, which had ſeveral bubbles of air intermixed with the iron, had depoſited a ſmall portion of a black powder. The water impregnated with fixible air had a ſtrong chalybeate taſte; the other a ſlight one.

Exp. XXXVII. To two ounces of diſtilled water I added 40 drops of the ſimple diſtilled water that had ſtood upon the iron filings, and to two ounces of diſtilled water in a ſeparate glaſs 40 drops of the diſtilled water impregnated with fixible air, that had likewiſe ſtood upon the iron filings. To each of theſe glaſſes I added forty drops of ſolution of galls. No change was produced in either for near half an hour; but in about 12 hours after, when I next examined it, that with the ſimple diſtilled water was not altered in colour, but the other was turned to a deep inky blackneſs.

This experiment confirms thoſe formerly made by Mr. Lane on the ſame ſubject.

Exp. XXXVIII. Half a drachm of copper filings was put into ℥ii of diſtilled water, and a like qnantity into ℥ii of diſtilled water impregnated with fixible air. After ſtanding a week they were examined. The copper filings in both were as bright as at firſt; but in the water impregnated with fixible air a yellowiſh flocculous ſediment had precipitated, and ſome degree of it in the ſimple diſtilled water. This circumſtance led me at firſt to think ſome ſolution of the copper had taken place; but on the other hand, the precipitation had nothing of the blue or green colour which all the ſolutions of copper have in ſome degree. I then ſuſpected that it was owing to ſome imperfection in the experiment, and that ſome granules of iron had either been abraded from the ſubſtance of the file, or rubbed from between the teeth, which might have been lodged there when it was employed for filing iron. I was confirmed in this opinion* by obſerving, that neither of the waters that had ſtood on the copper filings had any taſte of copper, but rather a chalybeate one, and that they produced no blue colour on addition of the vol. alkali, but a dark cloud with ſolution of galls.

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* A great proof that fixible air has very little if any effect on copper, is, that the Rings in the *King's-Bath* at BATH for the bathers to hold by, which are moſtly made of copper, and are many of them near a century old, and ſome of a longer date, are not apparently in the leaſt corroded or diminiſhed, while thoſe that are made of iron are eaten away and deſtroyed in a tenth part of the time. The Bath waters are largely impregnated with fixible air, as appears from their pungent taſte and quick precipitation of lime from lime water.

Exp XXXIX. Five grains of filings of lead were added to ℥ii of ſimple diſtilled water, and an equal quantity to ℥ii of diſtilled water impregnated with fixible air. After ſtanding a fortnight, they were both examined: The diſtilled water had precipitated a white ſediment apparently in a cryſtallized ſtate at the bottom of the phial. The other had no ſuch appearance. Both of them were perfectly clear and limpid.

Exp. XL. Forty drops of the ſimple diſtilled water and of the diſtilled water impregnated with fixible air mentioned in the laſt experiment to have ſtood upon filings of lead, were each added to ℥ii of ſimple diſtilled water in ſeparate glaſſes. To each of theſe were added forty drops of vol. tincture of ſulphur. In both a browniſh tinge was produced, but that with the diſtilled water was conſiderably the deeper of the two.

Exp. XLI. To ℥ii of each of the waters that had thus ſtood on the lead, I added forty drops of tinctura ſulph. volat.* That with the diſtilled water immediately formed a white pearly cloud; the other was ſcarce, if at all, affected. Pure water appears by theſe to have undoubtedly a power of diſſolving lead, and this power appears to be much increaſed, as might be expected, by the lead being reduced into ſmall particles. Doctor Baker † kept water on lead in a large piece a fortnight, without gaining any impregnation from it, and the like was the caſe with Dr. Percival in a great meaſure.‡ Doctor Baker however found that water by remaining long on lead, even in large bits, would at laſt diſſolve it, and the appearances he deſcribes in the ſpecimen ſhewn him by Dr. Heberden, reſembled very much thoſe in the experiment here related. It muſt be obſerved, however, that fixible air appears rather to prevent than increaſe the action of water on lead.

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* Forty drops of the ſame tinctura ſulph. vol. made no change in ℥ii of the ſame ſimple diſtilled water uſed in this experiment.

† *Vide* Medical Tranſactions.

‡ *Vide* Percival's Works.

EARTHY SUBSTANCES.

Calcareous Earth.

EARTHY ſubſtances next occur. Of theſe the calcareous was diſcovered by the Hon. Mr. CAVENDISH, to be ſoluble in water impregnated with fixible air, ſeveral years ago, and related in the Philoſophical Tranſactions. He diſcovered alſo that ſeveral mineral waters became impregnated with calcareous earth by theſe means. I had for ſome time a doubt relative to this fact, owing to the imperfection of my firſt apparatus, and ſome other circumſtances in the experiment. I am now however ſatisfied as to the truth of the fact; but muſt at the ſame time obſerve, that the quantity diſſolved is extremely ſmall, as will appear by the following experiments:

EXP. XLII. Two grains of waſhed chalk finely powdered, were added to rather more than a wine pint of diſtilled water, in a ſmall glaſs apparatus for impregnating water with fixible air on the plan of Dr. NOOTH. I ſhaked it up and mixed it thoroughly with the water, and ſent thro' it a large ſtream of fixible air, which continued to paſs through it in ſome degree above twenty-four hours together. But at the end of this I could not diſſolve the whole of the chalk by it; but about two-fifths remained. The water had acquired a ſtrong taſte of the fixible air.

Exp. XLIII. Two ounces of ſtrong lime-water were mixed with an equal quantity of water impregnated with fixible air. A white and copious precipitation immediately enſued. I then added ℥ii more of water thus impregnated, which rendered it rather leſs milky. I went on in this manner, and found it took near ſeven times and a half the quantity of the lime water to re-diſſolve the earth thus impregnated. As the water I uſed was as fully ſaturated with fixible air as I could make, we may compute by this experiment that lime water is nearly ſeven times and a half as ſtrong as a ſolution of calcareous earth in water, by means of the fixible air. It was extraordinary to obſerve how much the two ſolutions of calcareous earths differed from each other in taſte. Lime-water is well known to be auſtere and corrugating to the mouth, and rather nauſeous, with an empyreumatic flavour. But the very ſame earth when precipitated by fixible air, and re-diſſolved by it, imparted to water a ſoft milky flavour and pleaſant taſte, quite free of all empyreuma whatſoever. Perhaps it may be alledged, that the chalk uſed in Exp. XLII. was not pure, and that the part left by the water was ſome indiſſoluble ſubſtance; but I found that the reſiduum efferveſced ſtrongly with and entirely diſſolved in the vitriolic acid.

Exp. XLIV. Two ounces of water impregnated with calcareous earth by means of fixible air, were filtred off, and to them added three drops of oil of vitriol. No effervescence enſued. This laſt circumſtance is difficult to explain.—All the acids ſeparate fixible air from its earthy baſis and cauſe an effervescence when mixed with it; yet in this caſe no ſuch thing occurred. I do not pretend to ſolve the queſtion, but ſhall only obſerve, that it is one of thoſe facts that ſhould make us very cautious in natural philoſophy, and eſpecially chemiſtry, of drawing inferences from analogy.—Water impregnated with calcareous earth by means of fixible air, turns a ſolution of lacmus red, probably as being ſuperſaturated with fixible air.

Magneſia.

I ſuſpect that fixible air poſſeſſes a power of rendering magneſia ſoluble in water, as well as calcareous earths.

Exp. XLV. Twenty grains of magneſia were put into ℥ii of diſtilled water impregnated with fixible air, and corked up cloſe, ſhaken and ſet to ſtand. After ſtanding three days, it was examined, and the bulk of the magneſia was not perceptibly diminiſhed; but the water had acquired ſomething of an earthy taſte, had loſt all the pungency of the fixible air, and made no change on the colour of vegetable blues.

Exp. XLVI. To about half an ounce of the water that had ſtood on the magneſia, I added about five or ſix drops of ſolution of ſalt of ſteel in diſtilled water. It ſoon became turbid, and a precipitation of an ochery colour preſently took place.

Earth of Allum.

As earth of alum is acted upon by the acids in like manner with other abſorbent earths, I tried the effects of fixible air on it alſo.

Exp. XLVII. Twenty grains of earth of alum (which I prepared myſelf very carefully) were added to ℥ii of diſtilled water impregnated with fixible air. After ſtanding a week, it was examined, and a part poured off clear. The bulk of the earth did not appear diminiſhed, nor had the water acquired any peculiar taſte, though it had in a great meaſure loſt the pungency of the fixible air.

Exp. XLVIII. To an ounce of the water poured off clear from the earth of alum, I added about 15 drops of a ſolution of ſalt of ſteel in diſtilled water. No turbidneſs or precipitation enſued; but on adding a little earth of alum in ſubſtance, it grew cloudy, and an ochery precipitation was depoſited.

The above are all the experiments I have yet made. I ſhall now draw up in form of a Table, a general account of their reſult.

TABLE

OF THE

DISSOLVING POWER of WATER impregnated with FIXIBLE AIR

On MEDICINAL SUBSTANCES,

Comparatively with SIMPLE WATER.

* * *

SALINE SUBSTANCES SIMPLE.

Sal Succini.

VERY little difference in taſte or colour between the two ſolutions. By the experiment with the vegetable blues, that with fixible air appeared the ſtronger.

Flor. Benzoin.

THE ſuperiority of water impregnated with fixible air to ſimple water as a ſolvent, was here very perceptible, as appears from the ſmell and taſte, as well as from the experiment with the vegetable blues.

METALLIC SALTS.

Corroſive Sublimate.

Water impregnated with fixible air proved here much the quicker menſtruum. Whether it would diſſolve a larger quantity I did not try.

Calomel.

Neither of the menſtrua had any effect on this ſubſtance.

Emetic Tartar.

Simple diſtilled water was in this caſe ſuperior in ſtrength as a menſtruum to water impregnated with fixible air.

Salt of Steel.

Water impregnated with fixible air, and ſimple water ſeemed equally powerful as menſtrua, but the former let fall no precipitation on ſtanding, which in the latter was very copious.

INFLAMMABLE SUBSTANCES.

EXPRESSED OILS.

Olive Oil.

Fixible air did not appear to have the leaſt effect in promoting the ſolubility of oil in water.

Soap.

Fixible air ſeemed in this inſtance rather to promote the union of the ſoap with water.

Oil of Almonds, in form of Emulſion.

Fixible air appeared to have no power of ſeparating the oil from the water, as is the caſe with acids both in this inſtance and that laſt mentioned.

ESSENTIAL OILS.

Oil of Turpentine.

Fixible air did not appear to have any effect in promoting the union of oil of turpentine with water.

Eſſence of Lemons.

Fixible air in this experiment ſeems to have promoted the mixture of the eſſential oil with the water.

Water diſtilled from Caſſia buds.

Fixible air did not ſhew any power of rendering the oil of Caſſia ſoluble in water.

Peppermint Water.

Fixible air did not ſhew any power of diſſolving the oil of peppermint more than that of the Caſſia.

BALSAMS.

Balſam of Peru.

Both ſimple water and water impregnated with fixible air ſeemed to be equally ineffectual in diſſolving the balſam.

Balſam of Tolu.

Both the menſtrua were here equally ineffectual as in the laſt experiment.

Balſam of Capivi.

Neither of the menſtrua employed had any effect on this ſubſtance.

Camphor.

Fixible air appears by this experiment to have a conſiderable power of rendering camphor ſoluble in water.

GUM RESINS.

Aloes Socot.

Fixible air in this experiment ſeemed to prevent the ſolution of the aloes in water very conſiderably; the mixture with ſimple diſtilled water being much the ſtronger of the two.

Myrrh.

Water impregnated with fixible air ſeems inferior to common water as a menſtruum in this inſtance alſo.

Gum Ammoniacum.

Gum ammoniac appears to be miſcible in a larger quantity with ſimple water than when it is impregnated with fixible air. Probably there is no perfect ſolution in either caſe.

Opium.

Fixible air in this inſtance appeared to have no effect either in promoting or retarding the ſolution of the opium in water.

ANIMAL ESSENTIAL OILS.

Muſk.

Fixible air appears to prevent the ſolution of muſk in water.

Caſtor.

The impregnation in this caſe was very weak in both, but it did not appear in which it was moſt prevalent

SENSIBLE QUALITIES *of* VEGETABLES.

BITTERS.

Gentian.

Simple diſtilled water appeared here to be rather the more powerful menſtruum ; but the difference was not very great.

VEGETABLE ASTRINGENTS.

Oak Galls.

Simple water by this experiment appears to be a more effectual ſolvent of aſtringency than water impregnated with fixible air.

BITTERNESS *combined with* ASTRINGENCY.

Peruvian Bark.

The qualities of Peruvian bark appear to be equally well extracted by ſimple water and by water impregnated with fixible air.

Snake Root.

Simple water is ſuperior (as a menſtruum of the qualities of ſnake root) to water impregnated with ſixible air.

Rhubarb.

The difference here was very trifling; but ſimple water appeared to have rather the advantage.

Green Tea.

Simple water was found here alſo to be the more powerful menſtruum, but the difference was very ſlight.

Sulphur.

Neither ſimple water or water impregnated with fixible air had the leaſt effect in diſſolving this ſubſtance.

METALS.

Iron.

Water impregnated with fixible air has a conſiderable effect in diſſolving iron, whereas ſimple water has no ſuch effect, tho' it ſeems to have ſome in corroding it.

Copper.

Fixible air appears by theſe experiments rather to prevent than promote the ſolution of copper in water.

Lead.

Fixible air ſeems to have no effect in promoting the ſolution of lead in water.

EARTHS.

Calcareous Earth.

Fixible air has undoubtedly a power of rendering calcareous earth ſoluble in water;

but the quantity thus diſſolved is comparatively extremely ſmall.

Magneſia.

There is great reaſon to think (though no abſolute certainty) that fixible air renders magneſia ſoluble in water.

Earth of Alum.

Water impregnated with fixible air does not appear to affect earth of alum in the leaſt.

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IT muſt be obvious to every reader that the foregoing catalogue may be greatly increaſed and is at preſent very imperfect, and to be looked on rather as a beginning of ſuch an attempt, or ſketch of a plan, than in any other light. I propoſe, however, to purſue the ſame track, and am at preſent engaged in preparing materials for a farther enquiry into the powers of fixible air in increaſing or diminiſhing the effects of other menſtruums, particularly ſpirituous ones. I intend likewiſe to try it with acid and alkaline ſubſtances.

The experiments in this work are made chiefly with a view to medicine, and medicinal ſubſtances, from the different claſſes of bodies, are ſelected for that purpoſe, and ſuch chiefly as were either by themſelves inſoluble in water, or at leaſt miſcible but in ſmall quantity with it. Had I attempted it on a general plan, the experiments would have been more numerous than I had leiſure to make, and too bulky for the ſize of ſuch a work.

The reader may perhaps think that I have had but ſmall ſucceſs in this undertaking, and that the powers of fixible air in this way are not ſo great as to merit much attention.* I freely own I myſelf expected, from having before ſeen the experiment on camphor and ſome others, to have found fixible air aſſiſt the power of water as a menſtruum much more than it appeared to do by trial. But it is of conſequence in philoſophy to be acquainted with the negative as well as poſitive qualities of bodies, and this is particularly applicable to medicine. I flatter myſelf, however, that on the whole theſe experiments are not entirely without their uſe. Some ſubſtances appear to be diſſolved by water impregnated with fixible air, upon which ſimple water has no effect, ſuch as ſteel, calcareous earth, and magneſia; others are more largely diſſolved in water by the addition of it, as camphor, eſſence of lemons, ſalt of amber, flowers of benzoin, and probably corroſive ſublimate; others appear not to be affected by fixible air with reſpect to their miſcibility with water, as oils of olive, almonds, turpentine, caſſia, and peppermint; balſams of peru, tolu, and capivi; opium, caſtor, and Peruvian bark; while others, as emetic tartar, ſocotorine aloes, myrrh, gum ammoniac, muſk, gentian, oak galls, ſnake root, rhubarb, green tea, and lead, appear to diſſolve more readily in ſimple water than when impregnated with fixible air.

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* I found in theſe experiments that ſimple diſtilled water was a much more general ſolvent than it is generally imagined, and that its purity was of the utmoſt conſequence. Four grains of corroſive ſublimate diſſolved in two ounces of the common water uſed in diet, at this place, had in a week nearly precipitated half the quantity diſſolved, whereas twenty grains remained a month diſſolved in the ſame quantity of diſtilled water, and now ſhew no ſigns of precipitation.

As fixible air is now employed as a medicine, it is of importance to be acquainted with what ſubſtances it may be mixed without precipitating them from their menſtruums. This is eſpecially neceſſary with reſpect to antiſeptic ſubſtances, in which intention fixible air is chiefly employed. It is therefore of conſequence to know that an infuſion of peruvian bark in water impregnated with fixible air, is as ſtrong as one made with ſimple diſtilled water; and that the ſnake root, tho' not ſo eaſily ſoluble in water thus impregnated as in ſimple water, is yet ſufficiently ſo to be employed in that intention. Other obſervations of the ſame kind will readily ſuggeſt themſelves from a peruſal of the experiments.

I cannot at preſent diſcover any criterion whereby we can judge a priori of the effects of fixible air in promoting the ſolution of bodies in water. One of the metallic ſalts here tried, viz. corroſive ſublimate, appeared to be diſſolved in the water impregnated with fixible air more readily than in ſimple water, whereas the contrary was the caſe with emetic tartar. Soap ſeemed to unite with water impregnated thus full as readily as with ſimple water, and an oily emulſion had not the oil ſeparated by it, as is the caſe with acids, of which kind fixible air appears to be. Oil of turpentine reſiſts all union with water thus impregnated, while eſſence of lemons mixes with it much more readily than with ſimple water. Camphor likewiſe, which is of the ſame kind, is diſſolved by it much more readily and plentifully than by ſimple water. Some of the gum reſins have their union with water impeded by fixible air, as myrrh, aloes, and gum ammoniac; others are not affected by it, as opium. Some bodies are diſſolved in water by it, on which ſimple water has no effect, as iron, whereas lead and copper have their ſolution in water, rather prevented by it. Calcareous earth too, and magneſia, are diſſolved by it; and earth of alum not affected.

Perhaps the ingenuity of Dr. PRIESTLEY may furniſh us hereafter with ſome means of judging better of the effects it is likely to have in this way from a diſcovery of its properties and nature; but 'till that time, we muſt be contented to draw our information relative to its power, from experiments made with it on each particular ſubſtance, as our knowledge is at preſent too limited to admit of much reaſoning from analogy of its nature with other ſubſtances.

PART II.

DR. PERCIVAL of *Mancheſter*, in an ingenious eſſay of his lately publiſhed, has propoſed water impregnated with fixible air as a ſolvent for the calculus of the urinary paſſages, and ſeveral experiments made by him give us great reaſon to expect it may prove a uſeful and efficacious remedy. Being favoured with ſome calculi by Mr. SAMUEL SHARP, I made the following experiments, which appear to correſpond nearly with thoſe related by Dr. PERCIVAL, and evince the efficacy of water impregnated with fixible air, in relieving and even curing this painful and dangerous malady.

Feb. 16, 1776.

EXP. I. Two fragments of the ſame calculus were put, one weighing 4 grs. $\frac{1}{8}$ into a phial containing two ounces of ſimple diſtilled water; and the other, weighing 6 grs. into a phial containing two ounces of water impregnated with fixible air, and each ſet in a heat nearly equal to that of the human body. The calculi when put in, were each covered on the outſide in ſome places with a yellowiſh cruſt, and on the inſide were when broke of a ſhining cryſtallized appearance. After remaining three hours in this ſituation, I examined both the phials. That with the fixible air had the colour of the calculus changed to a whiter colour on the outſide; that in diſtilled water did not ſeem affected. I examined them a ſecond time the next day after their having remained about twenty hours in the room, tho' in a leſs degree of heat. The whiteneſs in the calculus in the water impregnated with fixible air was rather increaſed; the other much the ſame. I then took them both out, dried them gently before the fire, and again weighed them. That in the water impregnated with fixible air weighed 4 grs. $\frac{3}{4}$ and ſeemed in a crumbly ſtate on its ſurface. That in the diſtilled water weighed 3 grs. $\frac{5}{8}$ and was rather ſoftened, tho' not ſo much as the other. I then put them again each into freſh portions of the ſame fluid as before.

Feb. 18. I again took them out, and after drying them as before, weighed them. That in the water impreg. with fixible air weighed 4 grs. $\frac{3}{8}$; the other in the ſimple diſtilled water weighed ſome little leſs than 3 grs. $\frac{5}{8}$ as before,

before. That in the water impregnated with fixible air was grown very ſoft and mealy on the ſurface; the other was little affected. I then renewed the diſtilled water in the one, and the water impregnated with fixible air in the other as before.

Feb. 20. I again renewed the water, but did not weigh or examine them.

Feb. 22. I again renewed the water, but did not examine them.

Feb. 24. I took out the calculi, and after drying, examined them. That in the fixible air was very looſe and crumbly in its texture, ſo that I could ſcarce handle it without breaking; it weighed three grains only. That in the diſtilled water was rather crumbly on the ſurface, but conſiderably harder and firmer than the other, and weighed 2 grs. $\frac{5}{8}$. Since the 18th of *February* the calculi had ſtood in a room between 60 and 70 deg. of heat, but never were ſet by a fire or otherwiſe warmed.

March 3d. I again examined the calculi. That in the water impregnated with fixible air crumbled away conſiderably during the handling, (tho' I touched it as gently as poſſible) in taking it out of the phial, and ſtill more in drying. The outer yellow coat ſeemed to ſeparate or recede from the internal parts; it weighed 1 gr. $\frac{5}{8}$.—It was now ſo ſoft that I could ſcarce put it into the phial again without breaking. The other calculus in the diſtilled water was conſiderably ſoftened, but not much diminiſhed in ſize; it weighed 2 grs. $\frac{1}{2}$. It was however extremely fragile; and in handling it I happened to break it thro' the middle, which rendered it unfit for farther experiments in point of weight. I renewed the water in each.

March 20. I again examined the calculi. That in the fixible air fell all to pieces on touching it, tho' I handled it very gently. The other, tho' it was crumbly on the ſurface, was vaſtly harder and more firm, and in the middle part under the external yellow cruſt ſtill preſerved a conſiderable degree of hardneſs.

It ſhould be obſerved of the above experiments, that they were made under diſadvantageous circumſtances to the efficacy of the fixible air as a menſtruum, by the water thus impregnated not being often renewed. Had this been done as often as we may ſuppoſe it to be in the human body, and kept in a conſtant and regular heat, we have every reaſon to think that the ſolution would have been more expeditious and complete. But as it ſhewed great lithonthriptic powers in ſuch unfavourable circumſtances, and as it is perfectly ſafe with reſpect to the health in general, I cannot help recommending a trial of it to thoſe who are ſo unfortunate to be troubled with this malady.

EXP. II. *Feb.* 17. I took two portions of another calculus, like in appearance to the laſt, and of a hard conſiſtence; one portion, weighing 7 grs. $\frac{7}{8}$, I put into ℥ii of water impregnated with fixible air, and the other, weighing 3 grs. $\frac{5}{8}$, into two ounces of diſtilled water, and ſet them both, being corked up in phials, into a heat about 90 degrees, in which they remained three hours; and were then placed in a heat about 60 degrees, 'till about ſix the enſuing evening, when I again, after drying, weighed them. That in the water impregnated with fixible air weighed 6 grs. $\frac{5}{8}$, and was become very friable; the other was a little more friable than at firſt, and weighed 3 grs. $\frac{3}{8}$. I then renewed the diſtilled water in the one, and the mephitic water in the other as before.

Feb. 20 and 22. I again renewed the water; but did not examine the calculi.

Feb. 24. I took out the calculi, and dried and examined them. That in the water impregnated with fixible air weighed 5 grs. $\frac{5}{8}$, and was ſoft and crumbly, the yellow coat on its ſurface coming off in ſcales; the other in diſtilled water weighed 2 grs. $\frac{7}{8}$, and was rather ſoftened, but harder conſiderably than the other.

March 3d. I again examined the calculi. That in the water impregnated with fixible air was not much diminiſhed in ſize, but weighed only 3 grs. $\frac{1}{4}$; the yellow coat on its ſurface began to ſeparate from the inner nucleus, which was perfectly white. The other fragment in diſtilled water weighed 2 grs. $\frac{1}{8}$, but did not appear much, if at all ſofter than when laſt examined.

I RENEWED the waters reſpectively.

March 20. I again examined the calculi. That in the fixible air had ſeparated part of its ſubſtance in a coarſe powder in the phial. It was very ſoft and fragile on the ſurface, the outer coat peeling off on ſlight touching; it weighed three grains, but was much more fragile than when laſt examined. The fragment in the diſtilled water was much ſofter and more fragile, but ſtill weighed 2 grs. $\frac{1}{8}$.

April 27. I again examined them. That in the water impregnated with fixible air immediately fell into powder on being handled: that in ſimple water ſtill preſerved a conſiderable degree of tenacity, tho' it was crumbly on the outſide.

Exp. III. *Feb.* 17. I put another calculus of a rougher appearance and darker colour, inclining to brown, and of a ſofter texture, weighing 4 grs. $\frac{1}{8}$, into ℥ii of water impregnated with fixible air, corked the phial, and ſet it in a heat about 90 degrees, where it remained three hours.

Feb. 18. I took it out, and after drying it, examined it; its colour and texture were not altered; it weighed 3 grs. $\frac{7}{8}$. I renewed the mephitic water as before. *Feb.*

Feb. 20 and 22. I renewed the water, but did not examine the calculus.

Feb. 24. I took it out, and after drying, weighed it; it weighed 2 grs. $\frac{5}{8}$, and was very ſoft and crumbly. I renewed the water as before.

March 3d. I again examined it; after drying it weighed rather more than 2 grs. but leſs than 2 grs. $\frac{1}{8}$, was very ſoft and crumbly, inſomuch that with the greateſt care I could not help breaking ſome ſmall portions from it. I renewed the water.

March 20. I again examined it; it weighed 1 gr. $\frac{5}{8}$. Its conſiſtence much as before.

April 27. I again examined it; it broke into powder immediately on being touched.

Exp. IV. *Feb.* 17. I put another calculus ſimilar in appearance to that in Exp. I. weighing five grains, into ℥ii of water impregnated with fixible air, and ſet it for three hours in a heat about 90 degrees; next day I examined it; its texture was become more friable, and it weighed 4 grs. In putting it again into the bottle, a ſmall bit broke off which weighed nearly $\frac{1}{8}$ of a grain. I renewed the mephitic water as before.

Feb. 20 and 22. I renewed the water as before.

Feb. 24. I took the calculus out, and after drying, examined it. It weighed 3 grs. $\frac{5}{8}$, and was beginning to ſcale off in ſeveral parts. I renewed the water.

March 3d. I again examined the calculus after drying. It weighed three grains, and was become exceſſively ſoft and fragile, ſo that I could ſcarce touch it without its falling to pieces. I renewed the water.

March 20. I again examined the calculus. It was grown exceſſively ſoft and crumbly. It weighed 2 grs. $\frac{3}{5}$.

April 27. I again examined it. It broke to pieces on being touched, and fell into powder.

PART III.

On the Antiſeptic Power of Fixible Air.

FIXIBLE AIR having been recommended of late years by ſeveral perſons of eminence in the faculty as a powerful antiſeptic in putrid diſeaſes, an inquiry into its comparative efficacy in this way with the other remedies hitherto uſed with that intention, can neither be improper or unneceſſary. Scarce any diſorders incident to the human frame ſo much require to have the powers of the medicinal ſubſtances uſed in the cure ſtrictly aſcertained as thoſe of the putrid kind. In many other complaints, if one remedy fails, we may try another more efficacious; but in theſe, if advanced to any conſiderable height, the courſe of the diſeaſe is ſo rapid, as to admit of no delay in our choice of the moſt efficacious medicines and their being immediately adminiſtered. Nothing therefore of but weak efficacy can be admitted, which may prevent the exhibition of ſome more powerful application, or by inducing us to a falſe confidence in its powers, prevail on us to be negligent of the more important articles. To throw ſome light on the comparative efficacy of fixible air with the other antiſeptics generally uſed, and of their powers comparatively with one another, is the intent of the enſuing experiments, which are only here meant as relative to internal medicines, tho' their application may be extended farther.

The quantity of fluid is the ſame in each experiment, viz. eight ounces, which I mean ſhould be underſtood to contain as much of each medicinal ſubſtance as can conveniently be given at a doſe. Scarce any of them are ever given ſo much diluted; but as eight ounces of water impregnated with fixible air may, if neceſſary, be eaſily taken at a time, I choſe to put the ſame quantity of fluid in them all, that no difference might ariſe from the various degrees of dilution. The additional fluid is the ſame in all, viz. ſimple water.

April 10, 1776. Having procured a number of clean eight-ounce phials, I filled them in the following manner: Into one I put eight drops of oil of vitriol; into another a drachm and a half of dulcified ſpirit of nitre; into another an ounce of lemon juice and two drachms of ſugar; into another two ounces of Seville orange juice and two drachms of ſugar; into another eight ounces of China orange juice freſh ſqueezed and ſtrained through a ſieve; into another an ounce of white-wine vinegar; into another half a drachm of ſalt of amber; into another a drachm of nitre; into another a drachm of borax; into another half a drachm of alum; into another a ſcruple of ſalt of tartar; into another a ſcruple of volat. ſal ammoniac; into another a drachm of ſalt of tartar and an ounce and half of lemon juice which had been mixed together the day before; into * another a drachm of ſalt of tartar and an ounce of lemon juice, which was immediately corked up after having eight ounces of water added to it, and a bit of lean mutton of half a drachm weight hung in it by a thread; into † another a drachm of vol. ſal ammoniac and two

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* This and the following are intended to repreſent the effects of ſaline draughts freſh made, and the difference between them and thoſe wherein the fixible air has been diſſipated, with reſpect to their antiſeptic powers.

† This and the following experiments were made in larger phials of a pint contents and of ground glaſs, to prevent the running over of the liquor while it was efferveſcing.

two ounces of lemon juice, which was corked up immediately after being filled with water and having a bit of mutton hung in it as in the foregoing; into another twenty-five grains of camphor; into another a ſcruple of myrrh powdered; into another a ſcruple of balſam of peru; into another 50 drops of balſam of capivi; into another a drachm of cinnamon, groſsly powdered; into another a drachm and half of peruvian bark, in powder; into another 70 grains of peruvian bark in powder, and a drachm of cinnamon; into another a drachm and half of peruvian bark in powder and as much boiling water as to fill the phial; into another a drachm and half of peruvian bark and half an ounce of lemon juice; into another an ounce of brandy; into another an ounce of brandy and half an ounce of lemon juice; into another 5 ounces of old Port wine into another 5 ounces of old genuine Madeira; into another two ſcruples of powdered gentian; into another fifty grains of powdered ſnake-root; into another half a drachm of rhubarb powdered; into another half a drachm of caſcarilla in powder; into another a drachm of chamomile flowers; into another eight ounces of water impregnated with fixible air; into another eight ounces of ſpring water; into another eight ounces of diſtilled water. All the other phials, except the hot infuſion of peruvian bark, were then filled up with cold ſpring water, ſo that the quantity of fluid was nearly the ſame in all; and into each was put a ſmall bit of lean mutton of half a drachm weight, tender, but perfectly ſweet, and all cut from the ſame ſlice of meat, and hung in each phial by a thread faſtened to the cork. They were then all corked cloſe, and ſet on a table in a garret in my houſe in Bath, which had a weſtern aſpect, but which the ſun did not long ſhine upon in the afternoon. The window was kept conſtantly open during the whole courſe of the experiments.

The temperature was then (about three in the afternoon) 56 deg.

April 11. All of them perfectly ſweet.

April 12. Sal ſuccini not above $\frac{2}{5}$ diſſolved. Borax not above $\frac{2}{3}$. All of them ſweet and quiet, except that with nitre, which had ſome degree of a faint ſmell, but no ſigns of fermentation.

April 14. That with ſpirit of vitriol had ſomewhat of a rancid ſmell like tallow, but the liquor was quite clear and colourleſs, and the meat firm; that with the nitre had the ſmell increaſed and inclining to putrefaction, the liquor clouded, and the meat very tender; that with the ſalt of tartar had a ſlight faint ſmell, and the meat was of a very looſe conſiſtence; that with the vol. alk. had acquired a ſmell ſtill ſtronger than that with ſalt of tartar, and inclining to putrefaction, the meat was tender, but leſs ſo than that with the ſalt of tartar; all the others were perfectly ſweet; ſome inteſtine motion was diſcernible in that with the peruvian bark, and that with the ſnake root, but very ſlight.

April 15. The rancid ſmell in the phial with the oil of vitriol was become more perceivable, but the meat ſtill remained of a firm conſiſtence; that with the nitre was now become evidently putrid, and the meat appeared covered with air bubbles that ſeemed newly generated from it; that with the ſalt of tartar had the faint ſmell increaſed; and that with the vol. alkali was become evidently putrid; a faint ſmell was alſo perceivable in the phial with balſam of peru, and in this that with ſpring water, and that with diſtilled water; all the others were perfectly ſweet.

April 16. The phial with oil of vitriol had the rancid ſmell as before; that with the nitre was now become offenſive, and the meat very tender and diſpoſed to float on the ſurface of the liquor, and many air bubbles appeared to riſe from it; that with the ſalt of tartar had the faint ſmell rather increaſed, as was the putrid one in the vol. alkali; that with the balſam of peru was now approaching to a putrid ſmell; the ſpring water and diſtilled water had each the faint ſmell rather increaſed; all the reſt were ſweet; that with the China orange juice was beginning to ferment, as was that with the cinnamon; that with the peruvian bark alone was in fermentation, as was that with the peruvian bark with cinnamon, and that with the peruvian bark with lemon juice; that with Port wine likewiſe ſhewed ſome ſigns of it, but very ſlight; that with gentian was in ſlight fermentation; and that with ſnake root in one, rather ſtronger; that with caſcarilla in high fermentation, and ſome ſigns of it, tho' ſlight, in that with chamomile flowers; all the others were at reſt.

April 17. The faint ſmell in the phial with the oil of vitriol, ſtill increaſed, though the meat continued pretty firm; that with the nitre was now very offenſive, the meat conſtantly floating, much ſwelled in bulk, and very ſoft, with many air bubbles collected on the ſurface of the liquor; that with the ſalt of tartar was in ſmell much as before; and that with the vol. alk. become putrid and offenſive; that with the ſaline draught freſh made had acquired a little of a faint ſmell; and that with the balſam of peru had now a ſmell of putrefaction; that with the caſcarilla had a ſlight faint ſmell; that with ſpring water was very offenſive, and that with diſtilled water likewiſe, but not ſo ſtrong as that with the ſpring water; all the reſt were perfectly ſweet; that with the china orange juice was in high fermentation; that with cinnamon ſlightly fermenting; that with peruvian bark alone pretty briſk, as was that with the bark and cinnamon; that with the Port wine began to ſhew ſome ſigns of fermentation, bubbles forming on the ſurface, and the meat floating, but no inteſtine motion; that with gentian was ſtill in fermentation, as was that with ſnake root; that with the rhubarb now began to ſhew ſigns of fermentation; that with the caſcarilla was in high fermentation; and that with chamœmel moderately ſo.

April 18. That with the ſpirit of vitriol had the faint ſmell increaſed, and ſome air ruſhed out on opening the bottle, but the meat was ſtill moderately firm; that with the nitre was now become highly offenſive, and the liquor covered thick with air bubbles, the ſtench was ſo ſtrong as to render it neceſſary to be thrown away; that with the ſalt of tartar had the ſmell much as before; and that with the vol. alk. was become ſo offenſive as to be neceſſary to be thrown away; the faint ſmell in the phial with the ſaline draught freſh made, was rather increaſed; that with the camphor had acquired a putrid ſmell, joined with that of the camphor, and the like was the caſe with the phial with the myrrh; that with the balſam of peru was rather increaſed in ſmell; that with ſnake root began to emit a putrefactive ſcent, joined with that of the ſubſtance; that with the caſcarilla was now become rather putrid; the mephitic water had the faint ſmell rather increaſed; and the ſpring and diſtilled waters had become ſo putrid as to be neceſſary to be thrown away.

That with Seville orange juice and ſugar began this day to ſhew ſome ſigns of fermentation; that with china orange juice was in very briſk fermentation; and the ſaline draught that had ſtood open before the meat was put into it, began to ſhew ſome ſigns of it likewiſe; that with cinnamon was in high fermentation; that with peruvian bark alone moderately ſo; that with peruvian bark and cinnamon in briſk fermentation, and the hot infuſion of the bark ſhewed ſome ſigns of it; that with ſnake root was in high fermentation, and the rhubarb moderately ſo; that with caſcarilla was in briſk fermentation, and that with chamœmel ſo in ſome degree. All the reſt were perfectly ſweet and quiet.

April 19. The faint ſmell in the phial with the oil of vitriol was rather increaſed, but the meat was ſtill of a moderately firm conſiſtence; that with the ſalt of tartar had the ſmell rather abated, which was alſo the caſe with the ſaline draught freſh made; the ſmell of putrefaction in the phial with the camphor was now become more perceptible; that with the myrrh was much the ſame as before; that with the balſam of peru was become ſo offenſive as to be neceſſary to be thrown away; that with the ſnake root had the ſmell much as before, as was alſo the caſe with that which contained the caſcarilla; and the mephitic water was this day become ſo offenſive as be neceſſary to be thrown away. That with the Seville orange juice and ſugar was ſtill in fermentation, the meat floating in it, and very tender; that with the China orange juice was in high fermentation, and the meat floating, but of a firm conſiſtence; that with the ſaline draught which had ſtood open was ſtill in ſlight fermentation, as was that with cinnamon, and that with the peruvian bark alone, and that with the peruvian bark and cinnamon; ſome, tho' very ſlight marks of fermentation appeared in the phial with the red Port wine; that with the ſnake root was ſtill in fermentation alſo, as was that with rhubarb, that with caſcarilla, and that with chamœmel flowers; all the reſt were perfectly ſweet and quiet.

April 20. That with the oil of vitriol was now turned putrid in ſmell, tho' the liquor was clear and colourleſs, and the meat of a tolerably firm conſiſtence; that with the ſalt of tartar had the ſmell much abated; that with the ſaline draught freſh made was much the ſame as when laſt examined; that with the camphor had the ſmell rather increaſed; that with the myrrh was much the ſame; the putrefactive ſmell in the phial with the ſnake root was much as before, which was alſo the caſe with that containing the caſcarilla; all the reſt were perfectly ſweet; that with the Seville orange juice and ſugar was in fermentation, and that with the China orange juice very briſkly ſo; the ſaline draught that had ſtood open was alſo in fermentation, as was that with cinnamon; that with the peruvian bark alone had the fermentation nearly gone off; that with the peruvian bark and cinnamon was ſtill in fermentation, as were thoſe with ſnake root, rhubarb, and caſcarilla; that with chamœmel flowers had the fermentation nearly gone off; all the reſt were perfectly quiet.

April 21. That with the oil of vitriol had the ſmell much as before; that with the alum was moldy, but ſweet; that with the ſalt of tartar had acquired a ſmell of the volatile alkali; that with the ſaline draught freſh made had loſt the faint ſmell; that with the camphor had the ſmell rather increaſed; that with the myrrh was much the ſame; that with the brandy and lemon juice had a little of a faint ſmell, as was the caſe with the ſnake root and the caſcarilla; all the reſt were perfectly ſweet; that with the Seville orange juice and ſugar ſtill ſhewed ſigns of fermentation; that with the China orange juice fermented very briſkly; that with the ſaline draught that had ſtood open was in ſlight fermentation; that with the cinnamon alone, and that with the peruvian bark alone had each the fermentation nearly gone off; that with the peruvian bark and cinnamon was ſtill in high fermentation, as were thoſe with ſnake root and rhubarb; that with chamœmel flowers had the fermentation gone off; all the reſt were perfectly quiet.

April 22. That with the ſpirit of vitriol was now become offenſive, and was thrown away, the meat was become tender; that with the alum had a degree of a faint ſmell; that with the ſalt of tartar had a ſlight ſmell; that with the ſaline draught freſh made was ſweet again; that with the camphor was much as before, as was that with the myrrh; the faint ſmell in that with the brandy and lemon juice was abated; the ſnake root was much as before; and that with the caſcarilla rather ſtronger in ſmell; all the reſt were ſweet;

the lemon juice with ſugar ſhewed ſome ſigns of fermentation; the orange juice with ſugar, and theChina orange juice were both fermenting very briſkly; the ſnake root was ſtill in fermentation; that with the rhubarb had the fermentation much abated; all the others were at reſt.

April 23. That with the alum had the ſmell increaſed and become putrid, and was thrown away; that with the ſalt of tartar was much as before, and reſembling vol. alkali; that with the camphor had the ſmell rather increaſed, as was alſo the caſe with the myrrh; that with the brandy and lemon juice was in ſmell much as before; that with the ſnake root was rather ſtronger; that with the caſcarilla was now become putrid, and was thrown away; all the others were ſweet; the lemon juice with ſugar ſhewed rather more ſigns of fermentation than before; that with the orange juice and ſugar was in briſk fermentation, as was in a ſtill greater degree the China orange juice; the ſaline draught that had ſtood open, ſhewed ſome maks of fermentation; the ſnake root was ſtill fermenting; but the fermentation in the rhubarb had ceaſed; all the reſt were quiet.

April 24. The ſalt of tartar had the ſmell as before; the ſaline draught freſh made had the ſmell rather muſty, with ſeveral large ſpots of mold on the ſurface of the liquor, and the meat floating; the camphor had rather a putrid ſmell, as had the myrrh, and were both thrown away; the brandy and lemon juice had a ſlight ſmell of putrefaction; that with the ſnake root had an evident putrid ſmell, and was thrown away; all the reſt were ſweet; the lemon juice with ſugar was in briſk fermentation, as was the Seville orange juice with ſugar, and the China orange juice; the ſaline draught alſo that had ſtood open was in briſk fermentation, and the gentian ſhewed ſome marks of it; all the reſt were quiet.

April 25. The ſalt of tartar had the ſmell as before; the ſaline draught freſh made was become in ſmell very muſty, and the liquor very turbid and mouldy, and was thrown away; the brandy and lemon juice had the ſmell rather increaſed; all the reſt were ſweet; the lemon juice with ſugar had the fermentation rather abated, as had the Seville orange juice with ſugar, which laſt had a fermenting ſmell like a beer barrel; the china orange juice was in ſlight fermentation, as was the ſaline draught that had ſtood; all the reſt were quiet.

April 26. The ſmell of the ſalt of tartar was much as before; the volat. ſaline draught was very moldy, and the liquor very turbid, but ſweet; the brandy and lemon juice had the ſmell rather diminiſhed; the gentian had a muſty ſmell; all the reſt were ſweet; the lemon juice with ſugar ſtill ſhewed ſome ſigns of fermentation; the Seville orange juice with ſugar was in briſk fermentation, and the ſmell as before; the fermentation in the China orange juice had ceaſed, and the liquor was become very acid; the ſaline mixture that had ſtood was ſtill in fermentation; all the others were quiet.

April 27. The ſmell of the ſalt of tartar was much as before; the brandy and lemon juice had the ſmell nearly gone; the gentian was not more muſty in ſmell than before; all all the reſt were ſweet. The Seville orange juice with ſugar was ſtill in fermentation, as was very briſkly the ſaline mixture that had ſtood; all the reſt were quiet.

April 28. The vinegar ſmelt muſty and ſour; the ſalt of tartar was much as before; the gentian was rather more muſty; the brandy and lemon juice had the ſmell entirely gone; all the others were ſweet. The Seville orange juice with ſugar was in briſk fermentation, as was the ſaline mixture that had ſtood; all the reſt were quiet.

April 29. The muſty and ſour ſmell of the vinegar was rather increaſed; the ſalt of tartar was much as before, as was the gentian; all the others were ſweet. The orange juice with ſugar was in very briſk fermentation, as was the ſaline mixture that had ſtood; all the others were quiet.

*April*30. The muſty and ſour ſmell of the vinegar was rather increaſed; the ſalt of tartar was much as before; the ſmell of the gentian was rather increaſed; all the others were ſweet. The orange juice with ſugar was ſtill in briſk fermentation, as was the ſaline mixture; all the others were quiet.

May 2d. The muſty and ſour ſmell of the vinegar was much as before, as was the ſalt of tartar; the peruvian bark with cinnamon had rather a muſty ſmell, as had the hot infuſion of the bark likewiſe; the gentian had a muſty ſmell as before; all the others were ſweet. The orange juice with ſugar was ſtill in high fermentation; the China orange juice was quiet, but become very acid; the ſaline mixture was in briſk fermentation; all the others were quiet.

May 3d. The dulciſied ſpirit of nitre was ſweet, but the meat of a white colour and very moldy; the orange juice with ſugar was likewiſe ſweet, but with ſome ſpots of mold on the ſurface of the liquor; the vinegar had a muſty and ſour ſmell as before, but the colour of the meat was ſcarce altered; the ſalt of tartar had the ſmell rather abated; the vol. ſaline mixture had rather a muſty ſmell, and was very moldy, but the colour of the meat was not altered, but the liquor was of a reddiſh tinge; the cinnamon was rather moldy, but ſweet; the peruvian bark had a faint ſmell, approaching to putrefaction; and the peruvian bark with cinnamon, and the hot infuſion had both a muſty ſmell as before, but the colour of the meat in both was natural; the brandy with lemon juice was ſweet, but moldy; the gentian had the muſty ſmell increaſed, and was alſo moldy; all the others were ſweet. The lemon juice with ſugar had ſome ſmell of fermentation; the orange juice with ſugar was in a high ſtate of fermentation; the ſaline mixture was fermenting, but in a ſlight degree; the bark with lemon juice had a ſmell of fermentation, but no inteſtine motion; all the others were quiet.

May 5th. The dulcified ſpirit of nitre had a faint ſmell; the vinegar much as before; the ſalt of amber was rather muſty, but not putrefactive; the ſmell of the ſalt of tartar was very ſlight; the vol. ſaline mixture was rather muſty, as was the balſam of capivi; the cinnamon had likewiſe a muſty ſmell; and the peruvian bark a ſlight putrefactive one, and the liquor very turbid; the bark with cinnamon had alſo a muſty ſmell, as had the hot infuſion of bark, but not more than when laſt examined; the gentian had a ſtrong muſty ſmell, but not putrefactive; all the others were ſweet. The orange juice with ſugar had the fermentation much abated, which was alſo the caſe with the ſaline mixture; all the others were quiet.

May 7. The dulcified ſpirit of nitre had acquired a ſmell of the putrefactive kind, and the vinegar was become very turbid the vinegar had a ſour ſmell, but the muſtineſs was abated; the ſalt of amber was much as before; the ſalt of tartar had but little ſmell; the volatile ſaline mixture was rather muſty; the balſam of capivi had the muſtineſs increaſed; the cinnamon was much as before; the peruvian bark had the putrefactive ſmell rather augmented, and the liquor became very turbid; the peruvian bark with cinnamon was muſty as before; the hot infuſion of the peruvian bark had a ſlight muſty ſmell; the brandy with lemon juice was ſweet, but very moldy; the gentian was very muſty, but not putrefactive, and the liquor very muddy; all the reſt were ſweet. The orange juice with ſugar had the fermentation abated, but not quite ceaſed; the ſaline mixture was quiet, as were all the others.

May 9th. The dulcified ſpirit of nitre had the putrefactive ſmell rather abated; the ſalt of amber had the muſty ſmell rather leſs than before; the borax was rather muſty; the ſalt of tartar was much as before; the volatile ſaline mixture was rather muſty, and the balſam of capivi was ſo in a greater degree; the cinnamon was much as before, as was the peruvian bark; the peruvian bark with cinnamon had but little ſmell, but that was muſty; the hot infuſion of the peruviad bark had nearly loſt all its muſty ſmell; the gentian was become very muſty and nauſeous; the orange juice with ſugar was again in high fermentation, and the volatile ſaline mixture in ſome meaſure ſo likewiſe; all the others were quiet.

May 11th. The dulcified ſpirit of nitre had the putrefactive ſmell gone, but the liquor was very turbid; the vinegar had a ſour ſmell, but not a muſty one; the ſalt of amber had the muſty ſmell gone, as had the borax likewiſe; the ſalt of tartar had a very ſlight ſmell, and the vol. ſaline mixture ſcarce any; the balſam of capivi had the muſty ſmell as before; the cinnamon was become ſweet; the peruvian bark was become putrid, and the liquor very muddy, and was thrown away; the peruvian bark with cinnamon had ſcarce any ſmell; the hot infuſion of the bark was become quite ſweet; the gentian was very muſty, but ſcarce putrefactive; the others were ſweet. The orange juice with ſugar had the fermentation ceaſed, as had the volatile ſaline mixture; all the others were at reſt.

May 19. The dulcified ſpirit of nitre had again acquired a putrefactive ſmell; the ſalt of amber had a degree of a ſouriſh ſmell; the ſalt of tartar was become putrid, and was thrown away; the ſaline mixture alſo had acquired a degree of a putrid ſmell, and was thrown away; the vol. ſaline mixture was ſweet; the balſam of capivi was become putrid, and was thrown away; the cinnamon had alſo become putrid, and was thrown away likewiſe; the peruvian bark with cinnamon had alſo acquired a muſty and putrid ſmell, and was alſo thrown away; the gentian was become very muſty and rather putrefactive, and was thrown away likewiſe; all the others were ſweet. No fermentation was obſervable in any of them.

May 28. The dulcified ſpirit of nitre was become evidently putrid, and was thrown away; the borax alſo was become putrid, and thrown away, which alſo was the caſe with the rhubarb; the remainder were all ſweet. The lemon juice with the ſugar ſhewed ſome ſigns of fermentation; the reſt were all quiet.

June 18. The lemon juice with ſugar was ſweet, but the meat ſeemed in a diſſolving ſtate, with a large precipitation; the orange juice with ſugar had a ſour ſmell, and was rather muſty; the vinegar was rather moldy, but perfectly ſweet; the ſalt of amber was very moldy, but had no putrefactive ſmell, but one like moldy nuts; the borax was become putrid, and was thrown away; the volatile ſaline mixture had alſo a faint putrid ſmell, and was thrown away; the brandy alſo was grown putrid, and was thrown away; the the chamœmel alſo began to have a putrid ſmell, and was alſo thrown away; the remainder were all ſweet.

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THE imperfection of the foregoing experiments will readily appear to thoſe who are in any degree maſters of the ſubject. The number of ſubſtances tried, is greatly too ſmall, nor is fixible air properly diverſified thro' its ſeveral modes of compoſition, or tried with reſpect to its antiſeptic powers combined with other ſubſtances poſſeſſing qualities of that kind. The real truth was, that theſe ſentiments did not occur to me when I began theſe experiments, and moreover the number of them would have been too great and have taken up more time in their daily examination than I could ſpare from other avocations, eſpecially as for the ſake of accuracy of comparing them with one another, they were all neceſſary to be examined at the ſame time.—I propoſe, however, to purſue the ſubject, and have now a number of experiments in view for that purpoſe, wherein the effects of fixible air as an antiſeptic are tried in combination with other antiſeptics of known efficacy, and compared with the ſame ſubſtances tried ſeparately.

The foregoing experiments, however, I flatter myſelf, are not deſtitute of uſe, as they afford a comparative view not only of the antiſeptic qualities of water impregnated with fixible air, comparatively with other antiſeptics, but likewiſe of the comparative ſtrength of the antiſeptic ſubſtances uſually tried one with another.

The antiſeptic power of water impregnated with fixible air, appears by the above experiments to be very ſmall, as it ſcarcely retarded the putrefaction of the meat 24 hours longer than the ſimple water.

SPRING WATER is ſaid by ſome writers to be more antiſeptic than either rain water, or diſtilled water, and this appears to be the caſe with reſpect to itſelf, it not putrefying ſo ſoon in caſks as the ſofter waters; but it did not appear to retard the putrefaction of the meat in this inſtance longer than diſtilled water.

SEA SALT in *ſmall quantities was obſerved by Sir JOHN PRINGLE to accelerate the putrefaction of animal ſubſtances, and the ſame quality has been ſince obſerved of the ſal. catharticus amarus in a ſtill greater degree. But NITRE, according to Sir JO. PRINGLE's experiments, had no ſuch power, although it ſeemed to ſoften or reſolve the texture of the fleſh, though leſs than any of the other ſaline ſubſtances he made trial of. But in the above experiments, nitre manifeſted a conſiderable degree

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* Ten grains of ſalt to two drachms of freſh beef, and two ounces of water, was the proportion in which its putrefying effects were moſt obſervable.

degree of a ſeptic influence, cauſing a faint ſmell in the meat within ſixty hours after its firſt addition, and at the ſame time rendering the texture of the meat very looſe and tender, and within three days cauſing an evidently putrid ſmell to ariſe from it; whereas the meat kept ſo long in both ſpring and diſtilled waters without any ſmell or alteration of its firmneſs or conſiſtence. Nitre likewiſe not only appeared to haſten the putrefaction of meat, but alſo increaſed the degree of it, the ſmell being highly nauſeous; in ſix days the texture diſſolved, and the air ſeparated, and theſe circumſtances were increaſed ſo much in two days more as to render it neceſſary to be thrown away. How far the ſame obſervation may be extended to all the natural ſalts, I cannot ſay, but am inclined to think pretty general.

VOL. ALKALI likewiſe, which appeared by Sir JOHN PRINGLE's experiments to have a conſiderable antiſeptic power, ſeems by the foregoing experiments to have a contrary effect, one ſcruple of volatile alkali, or vol. ſal. ammoniac diſſolved in ℥viii of water producing in forty-eight hours a deep red tinge from the meat, which is generally a forerunner of putrefaction, and in three days a putrefactive ſmell, which daily increaſed until the eighth day, when it was neceſſary to be thrown away.

FIXT ALKALINE SALTS alſo appeared to Sir JOHN PRINGLE to have conſiderable antiſeptic powers, but as he ſays, rather leſs than the volatile alkaline ſalts. But by the foregoing experiments it appears that a degree of putrefaction was excited in the meat ſooner than in the ſtandard, and in much the ſame time that it appeared in the trial with the volatile alkali, tho' not quite ſo ſtrongly. But it muſt be obſerved ſtill of the *fixed alkali, that although the putrefaction came on ſooner in that than in moſt of the others, yet it did not riſe to any conſiderable height, and ſeemed in the end to act as a kind of preſervative.

THE SALINE MIXTURE in the act of efferveſcence has been eſteemed a powerful antiſeptic, and having not only the power of preſerving

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* This muſt be underſtood of the vegetable alkali, as that was here made uſe of.

ving meat from putrefaction, but of ſweetening it when putrid, and to be far ſuperior in antiſeptic powers to the ſaline mixture from which the fixible air has eſcaped. But in the preſent trial, which was made with all poſſible accuracy, the ſaline mixture in the act of effervеſcence appeared inferior as an antiſeptic, to that from which the air had eſcaped; the former emiting a faint ſmell on the ſeventh day, and growing putrid on the 15th; whereas the other kept the meat above double that time, and perfectly ſweet. It muſt however be owned, that there is no reaſon to ſuſpect the fixible air being retained as a haſtener of the putrefaction; as the volatile ſaline mixture under the ſame circumſtances proved a powerful antiſeptic; but how it would have been comparatively with the ſame mixture from which the fixible air had eſcaped, I did not try, but propoſe to do it in my next experiments. Sir JOHN PRINGLE mentions in his obſervations on antiſeptics, that "having found acids by themſelves to be very powerful antiſeptics; and ſince the alkaline ſalts alſo were of that claſs, it was natural to conclude, that a mixture of the two to ſaturation would reſiſt putrefaction little leſs than the acid alone. But in the trials he made upon fleſh with a ſpiritus myndereri compoſed of vinegar and ſalt of hartſhorn, and alſo with juice of lemons ſaturated with ſalt of wormwood, he found the antiſeptic virtue conſiderably leſs than when either of the acids or alkalies were uſed ſingly." This I found to be the caſe with reſpect to the acid in my experiments, an ounce and half of lemon juice neutralized, not preſerving the meat ſweet in one inſtance more than fifteen days, in another as far as I could gueſs more than thirty-ſix days, and in the other about forty-four days; whereas one ounce only of the juice unneutralized preſerved it a longer period, and in much warmer weather for the latter part of the time.

From my former obſervations concerning the ſeptic effects of alkaline ſalts, I cannot help aſcribing in ſome meaſure the diminution of the antiſeptic quality of the compound, in compariſon with the ſimple acid, to the ſeptic quality of the alkaline ſalt counteracting the effects of the acid, and thus rendering the compound leſs powerful in reſiſting putrefaction.

Oil of Vitriol has been generally eſteemed a powerful antiſeptic, as appears from the experimens of Dr. Macbride, and others; but in theſe experiments, eight drops of the ſtrong oil of vitriol, which gave a very ſenſible and not unpleaſant acidity to eight ounces of water, ſeemed to manifeſt ſo little of any antiſeptic quality in preventing the acceſs of putrefaction, that the meat in this experiment ſhewed ſigns of putrefaction, by emitting a rancid ſmell 24 hours before the ſtandard ſhewed any ſigns of it. It is indeed true of the vitriolic acid, as well as of the fixed alkaline ſalt, that tho' it ſeemed to haſten the putrefaction, it did not ſo ſoon riſe to ſuch a height as in the ſtandard phials; but the putrefaction even in this increaſed ſo faſt, that in twelve days I was compelled to throw it away: ſo that it is difficult to ſay from this, whether it had any antiſeptic qualities at all, or if it had not rather ſome contrary effect.

It muſt however be obſerved, that in moſt of the other mixtures, I found a bloody tinge given to the water, and a looſeneſs of conſiſtence in the meat, the general preludes to beginning putrefaction; but in this inſtance the water continued clear and colourleſs to the laſt, and the meat of a tolerably firm conſiſtence, tho' highly putrid and fœtid.

The Dulcified Spirit of Nitre in the proportion of ℥ iſs to 8 ounces of water, proved a powerful antiſeptic, preſerving the meat ſweet for above thirty-two days, which is at leaſt eight times longer than the ſtandard.

The Native Vegetable Acid, as lemon juice, in the proportion of one ounce to ſeven ounces of water, and as much ſugar as was ſufficient to render it palatable, proved a ſtrong antiſeptic, preſerving meat ſweet ſeventy-four days, and probably would have done it much longer, which is at leaſt above eighteen times longer than the ſtandard. Seville orange juice mixed in the ſame proportion with water, and a little ſugar to make it pleaſant to the taſte, proved a powerful antiſeptic, preſerving meat ſweet as long as the lemon juice; but at the ſame time it muſt be obſerved, that the operation was not ſo uniform, the meat that was immerſed in it having manifeſted a degree of muſtineſs, which indeed ſoon went off, but was never obſerved in the other.

But the moſt powerful of any of the antiſeptics I tried, was the *juice of China oranges*; this preſerved the meat firm, entire, and perfectly ſweet for ſeventy-four days and upwards, which is upwards of eighteen times longer than the ſtandard, and probably would have done it for a much longer time: whether it owed its extraordinary antiſeptic property to its being converted into vinegar by fermentation, I ſhall not determine.

Vinegar itſelf likewiſe was very powerfully antiſeptic in preſerving the meat from abſolute putrefaction; but at the ſame time, it did not keep it from turning mouldy, and having a muſty ſmell, which indeed, like many of the others, went off again, but ſtill the meat remained of a lax and tender conſiſtence.

Alum, which Sir John Pringle found to be ſo powerful in reſiſting putrefaction, I was ſurprized to find, proved but a weak antiſeptic, half a drachm diſſolved in ℥viii of water reſiſted putrefaction only about three times longer than the ſtandard, which is ten times leſs than Sir John Pringle's computation; it preſerved the meat however tolerably firm to the laſt.

BORAX, which Sir JOHN PRINGLE found ſo powerful an antiſeptic, appeared likewiſe by my experiments, to poſſeſs that quality in a high degree,* two ſcruples of it diſſolved in ℥viii of water, proved at leaſt ten times ſtronger than the ſtandard, and poſſibly more, which brings it nearly to the place aſſigned it by Sir JOHN PRINGLE.

BUT the moſt powerful of any of the ſaline antiſeptics I made trial of, was SAL. SUCCINI or SALT of AMBER†; twelve grains of this diſſolved in eight ounces of water, reſiſted putrefaction above eighteen times longer than the ſtandard, and probably would have done it much longer, and preſerved the meat firm and entire during that time. This agrees with Sir JOHN PRINGLE's account, who places this ſubſtance among the ſtronger antiſeptics, being, according to his computation, conſiderably above twenty times ſtronger than the ſtandard or ſea ſalt.

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* ʒi of Borax was added to the water, but not above 2-3ds diſſolved; ſo no greater quantity could be ſuppoſed in the preſent caſe to exert any antiſeptic powers.

† ʒſs of Salt of Amber was the quantity added, but not more than 2-5th diſſolved.

OF all the antiſeptic ſubſtances CAMPHOR was the one from which I had the higheſt expectations; Sir JOHN PRINGLE found it to be at leaſt *ſixty, and probably three hundred times ſtronger than ſea ſalt. But in my experiments, twenty-five grains mixed with eight ounces of water reſiſted putrefaction not twice as long as the ſtandard, which was no more than what was done by many of the weaker antiſeptics. Perhaps this was owing in a great meaſure to the ſmallneſs of the quantity diſſolved, which was undoubtedly very little, the whole of the camphor to appearance remaining in a ſolid form floating on the ſurface of the liquor. But notwithſtanding this, the water was very ſtrong of the camphor both in ſmell and taſte.

Dr. GRIFFIN, of *Virginia*, who in the year 1765, publiſhed an inaugural Theſis on the effects of camphor, has related ſome experiments, which he made with it as an antiſeptic, which nearly coincide, in proportion of its antiſeptic quality, with thoſe I have related.

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* When Sir JOHN PRINGLE tried camphor with the ſerum of the blood, he found it not more than a fourth ſo antiſeptic as is here related.

As this Theſis is probably but in few hands, and as the experiments are curious and extremely accurately made, I have ſet them down here by way of compariſon to my own on the ſame ſubject.

“ The following were expoſed to a heat of 96 degrees of Farenheit's thermometer :

	Hours.
Two ounces of blood and two ounces of ſimple water putrified in -	18
Two ounces of blood and two of lime water, in - - - -	18
Two ounces of blood, two of lime water, with ſix grains of camphor, in	40
Two ounces of blood and two of very ſtrong lime water, with ſix grains of camphor, in - - -	40
Two ounces of blood and two of ſimple water, with ſix grains of camphor diſſolved in a little olive oil, in -	36

Two

	Hours.
Two ounces of blood and two of ſimple water with ſix grains of camphor diſſolved in five drops of rectified ſpirits of wine, in	78
Two ounces of blood and two of ſimple water, with a drachm of common ſalt, in	38
Two ounces of blood and two of ſimple water, with a drachm of purified common ſalt, in	40
Two ounces of ſerum of blood and two of ſimple water, in	30
Two ounces of ſerum of blood and two of lime water, with ſix grains of camphor, in	71
Two ounces of ſerum of bloodand two of ſimple water, with ſix grains of camphor diſſolved in a little olive oil, in	67
Two ounces of ſerum of blood and two of ſimple water, with a drachm of common ſalt, in	69

Two

	Hours.
Two ounces of ſerum of blood and two of water, with a drachm of purified common ſalt, in	70
Two ounces of the congealed part of the blood, or craſſamentum, with two ounces of ſimple water, in	26
Two ounces of craſſamentum and two of lime water, with ſix grains of camphor, in	44
Two ounces of craſſamentum and two of ſimple water, with ſix grains of camphor diſſolved in a little olive oil, in	41
Two ounces of craſſamentum and two of ſimple water, with a drachm of common ſalt, in	42
Two ounces of craſſamentum with two ounces of ſimple water, with a drachm of purified common ſalt, in	43

" The following experiments were expoſed only to the heat of the chamber, which was ſixty-four degrees.

	Hours.
Two ounces of blood and two of water putrified in	55
Two ounces of blood and two of lime water, with four grains of camphor, in	90
Two ounces of blood and two of ſimple water, with four grains of camphor diſſolved in a little olive oil, in	72
Two ounces of blood and two of ſimple water, with four grains of camphor diſſolved in a litle rectified ſpirits of wine, in	126
Two ounces of blood and two of ſimple water, with a drachm of common ſalt, in	88
Two ounces of blood and two of ſimple water, with a drachm of purified common ſalt, in	92

" But although camphor appears to have a conſiderable power in preventing putrefaction in animal ſubſtances, yet it does not appear to have any power of reſtoring animal bodies, already putrefied, to their former ſweetneſs and firmneſs of texture, as will appear by the following experiment :

" A PIECE of putrid fleſh was immerſed in a ſolution of camphor in water, made by means of quick-lime; but after remaining in it ſeveral days, neither the ſweetneſs or firmneſs was reſtored in any degree. The ſame experiment was tried with ſolutions of camphor made in various ways, but all without the leaſt effect in reſtoring the ſweetneſs or firmneſs of the meat."

THESE experiments of Dr. GRIFFIN, the reader will obſerve, tally pretty nearly in proportion of time with thoſe I have related. —In theſe experiments, the blood and water alone putrified in the heat of 96 degrees in eighteen hours; when ſix grains of camphor were added, it retarded the putrefaction ſomewhat above double that time.

THE like proportion, in reſpect of time, ſeemed to hold pretty nearly both with reſpect to the ſerum and craſſamentum of the blood, when they were tried ſeparately. In my experiments, a piece of meat immerſed in ſimple water began to putrefy in a little above four days; but by the addition of camphor, it kept ſweet double that time. Pretty nearly the ſame proportion is obſerved to hold between Dr. GRIFFIN's experiments, made with a leſs degree of heat, and thoſe of my own, which I have related.—It is remarkable, that the Olive Oil ſeemed to diminiſh the antiſeptic power of the camphor, while the rectified ſpirit ſeemed to increaſe it, tho' not more than a few drops of either were uſed in any one experiment. Was this owing to the camphor being more miſcible with water when diſſolved by ſpirits, than when diſſolved by oil, or did the olive oil, which is generally in a rancid ſtate in this country, communicate any putrid ferment which haſtened its decay?

MYRRH likewiſe, which Sir JOHN PRINGLE found to be ſo powerful an antiſeptic, appeared in my experiments to have but a weak influence in preventing putrefaction, twenty grains of it mixed with ℥ii of water, retarded putrefaction, as nearly as could be judged, as long as the camphor did*, which is not quite twice as long as the ſtandard. Perhaps this might in part be owing to its imperfect ſolution; but I muſt obſerve at the ſame time, that tho' the myrrh was not all diſſolved, yet that the water both ſmelt and taſted of it very ſtrongly.

BALSAM of PERU, in the proportion of 20 drops to 8 ounces of water, I found to have very little effect in retarding putrefaction; the meat began to ſmell faint on the 5th day, and on the 9th was ſo offenſive as to be neceſſary to be thrown away. Perhaps this might be owing to the difficulty of mixing the Peruvian Balſam with water, tho' it indeed imparted to it a conſiderable degree both of ſmell and taſte, yet it appeared to float ſeparate on the ſurface.

BALSAM of CAPIVI I found however, to reſiſt putrefaction pretty ſtrongly; fifty drops of

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[*] Sir JOHN PRINGLE accounted Myrrh to be about thirty times ſtronger than the ſtandard, or about half the ſtrength of Camphor, when the latter is computed at the loweſt calculation of its ſtrength.

of it added to ℥viii of water, preſerved a piece of meat twenty-four days, which is ſix times longer than the ſtandard. Perhaps this difference between the two balſams might be owing to its being eaſier miſcible with water than the balſam of Peru, as being of a thinner conſiſtence, and admitting of more ready diffuſion through the fluid.

Cinnamon I found a very powerful antiſeptic ſubſtance; one drachm to eight ounces of water preſerved the meat perfectly ſweet and firm in its texture twenty-four days, which is ſix times longer than the ſtandard, nor did the putrefaction come on but exceedingly ſlowly afterwards, and when it was thrown away, which was not until a fortnight afterwards, the fœtor was very ſlight.

Peruvian Bark in powder by itſelf, I found a ſtrong antiſeptic, but rather inferior to what is generally repreſented. Sir John Pringle found the bark not only to prevent putrefaction, but to reſtore both ſweetneſs and firmneſs to animal ſubſtances already become putrid; but Dr. Macbride could not produce the ſame effect in his trials. By theſe experiments the bark appeared in the proportion of ʒiſs to ℥viii of water, to keep the meat ſweet and firm twenty-two days, which is above five times longer than the ſtandard; but after that time, the putrefaction came on faſt, and increaſed to a great degree.

THE PERUVIAN BARK mixed with cinnamon, I found to be full as antiſeptic as when uſed alone; ſeventy grains of the bark in powder, with twenty grains of cinnamon, preſerved the meat ſweet about as long as the peruvian bark alone, and when any ſmell came, it was not of the putrefactive kind like that with the bark alone, but rather muſty, which increaſed very ſlowly and was not very ſtrong ſeventeen days afterwards, when it was thrown away.

THE HOT INFUSION of the BARK I found much more antiſeptic than the cold ones; a drachm and half of bark made into infuſion, with ℥viii of water, preſerved the meat ſweet and firm ſeventy-four days, which is above eighteen times longer than the ſtandard, and would probably have preſerved it a conſiderable time longer. This circumſtance juſtifies Sir JOHN PRINGLE's opinion of the great antiſeptic

tiſeptic qualities of the bark, as he uſed it in this form principally in his experiments. Probably the ſuperior antiſeptic quality of this preparation of the bark might be owing to the reſinous part being melted out by the heat and brought into contact with the meat, which would not be the caſe in the cold infuſion.

The addition of the Vegetable Acid to the bark, I found greatly to increaſe its antiſeptic virtues; a drachm and half of the bark and half an ounce of lemon juice preſerved the meat perfectly ſweet ſeventy-four days, or eighteen times longer than the ſtandard, and would probably have kept it ſweet a longer time. But at the ſame time, I muſt obſerve, that the meat had not near the ſame degree of firmneſs of texture with that immerſed in the hot infuſion, but was rather tender and ſoft.

Snake-Root, which is eſteemed by many a very powerful antiſeptic, appeared by theſe experiments, to have but moderate powers of this kind; fifty grains of it added to ℥viii of water, did not preſerve the meat ſweet above nine days, which is not more than twice as long as the ſtandard. It muſt likewiſe be obſerved, that the fermentation which ſoon came on in this phial, and continued for ſeveral days, did not in the leaſt retard the putrefaction, which went on increaſing during the fermentation until it became neceſſary to throw it away. This is an inſtance which contradicts Doctor MACBRIDE's theory, and proves that the fermentation of a liquor does not always prevent the putrefaction of the animal ſubſtances immerſed in it.

CASCARILLA I alſo found but a weak antiſeptic; half a drachm of it mixed with ℥viii of water, retarded the putrefaction only ſeven days, which is not double the time of the ſtandard. This too was another inſtance that fermentation has but little effect in either preventing or retarding the putrefaction of an animal ſubſtance immerſed in the fermenting liquor.

GENTIAN-ROOT I found to poſſeſs a moderate degree of antiſeptic power; two ſcruples of it mixed with eight ounces of water, preſerved the meat perfectly ſweet about ſixteen days, which is four times longer than the ſtandard; and afterwards the putrefaction came on very ſlowly, and indeed ſcarce any ſmell that could properly be called putrefactive, was perceivable for near three weeks after.

Rhubarb I found to poſſeſs a conſiderable antiſeptic power; half a drachm of it mixed with eight ounces of water, preſerved the meat perfectly ſweet upwards of forty days, which is ten times longer than the ſtandard.

Chamomile Flowers were found by Sir John Pringle to be exceedingly ſtrong antiſeptics; and this I found abundantly confirmed in my experiments; one drachm of the flowers with ℥viii of water, preſerved the meat perfectly ſweet upwards of fifty days, which is above twelve times longer than the ſtandard, and afterwards it appeared to corrupt very ſlowly.

Red Port Wine I found an extremely ſtrong antiſeptic; five ounces of it mixed with 3 of water, preſerved the meat perfectly ſweet and of a firm conſiſtence upwards of ſeventy-four days, which is above eighteen times longer than the ſtandard, and probably would have done it a conſiderable time longer.

Madeira Wine in the ſame proportion, I found equally antiſeptic with Port; but the meat, though firm, was not ſo hard as that in the Port wine.

French Brandy, in the proportion of one part to ſeven of water, I found very antiſeptic; but inferior to the two laſt mentioned. It preſerved the meat ſweet as far as I could gueſs, about fifty days, which is above twelve times longer than the ſtandard.

Brandy mixed with Lemon Juice in the proportion of an ounce of brandy to ℥ſs of lemon juice, and ſix ounces and half of water, was more antiſeptic than brandy alone, preſerving the meat ſweet about ſeventy days, or above ſeventeen times longer than the ſtandard*.

I shall next add a table of the comparative ſtrength of the antiſeptics I made trial of.—To form a ſcale for this may appear difficult, as ſome of them are in a fluid and others in

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* The meat in this ſhewed ſome ſigns of putrefaction about ten days after it was put in; but afterwards became perfectly ſweet, and remained ſo ſeventy days.

a ſolid form, and were beſides tried in different proportions and quantities. But the reader will recollect, that I have before mentioned, that the quantity of the ſubſtance uſed in each experiment, was ſuch as might be adminiſtered at one doſe conveniently, which puts the different quantities of each in ſome meaſure on the ſame footing, with reſpect to the effects on the human body expected from them. Thus, when I put the peruvian bark down in the table as a more powerful antiſeptic than alum, I do not mean that equal parts of each ſubſtance were compared, but only that a quantity of Peruvian Bark which might be taken at a doſe, was more antiſeptic than as much alum as was ſufficient for a doſe or could be ſafely adminiſtered at one time.

As to the different proportions which the ſeveral ſubſtances bear with reſpect to one another in degree of antiſeptic quality, I have deduced theſe from the length of time which they preſerved the meat ſweet, taking the diſtilled water for a ſtandard. Thus when I put down ten oppoſite to rhubarb, or twelve oppoſite to chamomile flowers, I mean that the one is ten times, and the other twelve times more antiſeptic than ſimple water, by which the different proportions of this quality in every ſubſtance may be compared. I acknowledge this method to be far from accurate, as we cannot determine that the time is a true meaſure of the proportion of this property, and moreover, the firmneſs of the meat ſhould be taken into conſideration; and beſides, one ſubſtance may be accounted more antiſeptic than another, as it may be oftener adminiſtered, or the doſes oftener repeated with ſafety. Thus ſuppoſing a quantity of the Peruvian Bark which might be taken at one time, equal in antiſeptic power to a doſe of Camphor or Opium; the former might nevertheleſs, be ſaid in a medicinal view to be much the more powerful antiſeptic, as we might ſafely repeat it often, which could not be the caſe with the other, except the quantity was very ſmall, in which caſe it would probably be ſcarce ſufficiently powerful as an antiſeptic. But this method, though very imperfect, is as good as any I can ſuggeſt, and will afford ſome inſight into the relative power of the ſubſtances, though it may not be exact in the degrees.

SIR JOHN PRINGLE drew the proportion in his calculations, from the quantity of the ſubſtance employed. Thus when three grains of Borax preſerved a piece of meat as long as ſixty grains of Common Salt, which he took as his ſtandard, he judged it to be 20 times more antiſeptic, and ſo of the others. But as I tried my experimens with ſuch various quantities of each ſubſtance, and as fluid bodies alſo were employed, this method could not be adopted. Sir JOHN PRINGLE's method was not, I think, more likely to point out the true proportions of this quality, than that I have made uſe of, as he found upon trial, that ſubſtances do not exert an antiſeptic quality in proportion to the quantity in which they are uſed. Thus, Sea Salt is ſeptic in a ſmall quantity, and in a large one antiſeptic, and the ſame is true of ſeveral other ſubſtances. It is therefore highly probable, that the antiſeptic quality of moſt bodies increaſes in a much greater degree than in proportion to the quantity uſed.— Thus 100 grains of Sea Salt is much more than twice as antiſeptic as 50; and the ſame holds in ſome meaſure of other bodies endued with this quality, though probably they do not all equally increaſe in their antiſeptic power as the quantity uſed of each is increaſed.

TABLE *of the* COMPARATIVE POWER *of ſeveral* SUBSTANCES *reputed* ANTISEPTIC.

Diſtilled water is a ſtandard	1
Spring water	1
Nitre	$\frac{1}{2}$
Vitriolic Acid	$\frac{3}{4}$
Vol. Alkali	$\frac{3}{4}$
*Fixed Alkali	$\frac{3}{4}$
Balſam of Peru	1
Mephitic Water	$1\frac{1}{4}$
Saline Mixture freſh made	$1\frac{1}{4}$
Camphor	$1\frac{1}{2}$
Myrrh	$1\frac{1}{2}$
Caſcarilla	$1\frac{1}{2}$
Snake-root	$1\frac{1}{2}$
Alum	$2\frac{1}{2}$
Gentian	4
Vinegar	$4\frac{1}{2}$
Peruvian Bark by itſelf	5
Peruvian Bark with Cinnamon	5

Cinnamon

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* I have ſome doubts as to the propriety of placing this ſubſtance here, ſince though it evidently induced the putrefaction ſooner, it evidently retarded it afterwards, and prevented its riſing to any great height.

Cinnamon	6
Balſam of Capivi	6
Dulcified Spirit of Nitre	8
Saline Mixt. with the Fix. Air diſſipated	9
Borax	10
Rhubarb	10
Vol. Saline Mixture	11
Brandy	12
Chamomile Flowers	12
Brandy and Lemon Juice	17
Peruvian Bark, hot infuſion of,	18
Peruvian Bark with Lemon Juice	18
Port Wine	18
Madeira Wine	18
Lemon Juice with Sugar	18
Seville Orange Juice with Sugar	18
China Orange Juice alone	18
Salt of Amber	18

In the above table I have began with the weakeſt, or ſuch as have really no antiſeptic quality, or rather a contrary one, which is expreſſed by fractional parts; thus, $\frac{1}{2}$ is put down oppoſite to Nitre, by which I mean it putrifies in half the time of the ſtandard, and ſo of the others. The proportional numbers are not accurate, but I believe not very diſtant from truth. At leaſt, the order in which the ſubſtances ſtand, (the eight laſt excepted, of which I cannot ſay which is the ſtronger) is, I am ſatisfied right, with ſome doubt only relative to the Saline mixture freſh made. But this experiment I ſhall repeat, though I have no reaſon to think the former inaccurate from any other circumſtance than the remarkableneſs of the event.

I have likewiſe inſerted a table of the comparative power of antiſeptics, extracted from Sir JOHN PRINGLE's works on this ſubject; but muſt warn the reader, that the numbers expreſſive of the ſtrength of the antiſeptics, are not to be compared with thoſe in the foregoing table, as the computation is taken from a different circumſtance.

TABLE *of the* COMPARATIVE POWER *of ſeveral* ANTISEPTIC SUBSTANCES.

*Sea Salt	1
Sal. Gemmæ	1†
Vitriolic Tartar	2

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* Sixty grains of Sea Salt diſſolved in two ounces of ſoft water was taken as the ſtandard.

Spiritus Myndereri	2
Soluble Tartar	2
Sal. diureticus	2†
Sal. Ammoniac	3
Saline mixture	3
Nitre	4†
Salt of Hartſhorn	4†
Salt of Wormwood	4†
Borax	12†
Salt of Amber	20†
Alum	30†
Myrrh	30
Aloes	30
Aſafœtida	30
Terra Japonica	30
Camphor	60 at leaſt, perhaps 300
Snake-root	120
Chamomile flowers	120
Peruvian Bark	ſomewhat, leſs than the two laſt
Pepper	at leaſt 12
Ginger	
Saffron	
Contrayerva	
Galls	
Sage	at leaſt 6
Valerian	
Rhubarb	

The above refer to the effects of antiſeptic ſubſtances on the ſolid or fibrous parts of animals.—Thoſe which follow refer to their effects on the humours.

Salt of Hartſhorn	- - -	4
Nitre	- - - -	4
Saffron	- - - -	3
Camphor	15 at leaſt, perhaps above	73

Thoſe to which the ſign † is added, imports, that they are ſtronger than the number in the table by ſome fraction, except in the Borax, Salt of Amber, and Alum, wherein the ſame ſign imports, that they may be ſtronger by ſome units.

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Observations *on the foregoing* Experiments.

THE Antiſeptic Power of *Water impregnated* with *Fixible Air* appears by the foregoing experiments to be ſo ſmall, that little ſtreſs ſhould be laid on it in putrid diſorders. If we wiſh to introduce Fixible Air in large quantity, ſome of the briſk fermenting liquors, as cyder; perry; ſome of the made wines, as that of oranges; ſmall beer;

beer, porter, &c. ſeem much preferable to mephitic water, as they not only contain a larger quantity of air, but hold it alſo united with a ſpirituous body of a moderate ſtrength, which poſſeſſes itſelf an antiſeptic quality.

THE *Vitriolic Acid* diluted with water, is frequently given as an antiſeptic in putrid diſeaſes; but from the above account of its effects, the propriety of this may be juſtly doubted, it appearing to poſſeſs very little, if any, antiſeptic power, and poſſibly a contrary one. Probably this was one reaſon why the Vitriolic Acid appeared to be of little or no ſervice in the ſea ſcurvy, in which it was adviſed to be tried by many great phyſicians.

Dulcified Spirit of Nitre duly diluted with water, appears a very proper drink in fevers, being conſiderably antiſeptic, and at the ſame time diuretic and not ſo liable to excite flatulency as the fermentable acids.

Lemon Juice mixed with water and ſweetened to a proper degree, forms a powerful antiſeptic, as well as an elegant cooling liquor, and extremely proper in moſt kind of fevers, putrid ones eſpecially. On this account it is much preferable to the mineral acids, the vitriolic eſpecially, and is moreover much more agreeable to the palate.

Orange Juice made up in the ſame manner is, I think, rather leſs antiſeptic than *Lemon*, and is rather leſs agreeable in general, as it does not quench the thirſt ſo well.

China Orange Juice is a moſt powerful antiſeptic, and highly proper in all putrid caſes; its effects in the ſea ſcurvy are well known, and it appears equally proper in all kinds of putrid fevers. Its antiſeptic powers appear by this experiment, to be very great, and to preſerve not only the ſweetneſs, but alſo the firmneſs of texture of the meat, which the other acids ſeemed rather to injure: Another circumſtance that tends to recommend the uſe of this ſubſtance in putrid fevers, is, that it is conſiderably nutritive, which is a thing highly to be wiſhed for in whatever remedies we adminiſter in ſuch complaints.

Vinegar appears by theſe experiments to be a very powerful antiſeptic; but in my opinion, leſs proper in putrid diſeaſes than the native vegetable juices, as it does not preſerve the firmneſs of texture nearly ſo much and is beſides of a much leſs agreeable taſte, which laſt circumſtance is eſpecially neceſſary to be attended to, conſidering how delicate the ſtomach is in ſuch diſorders.—Perhaps its not ſucceeding in the ſea ſcurvy, may be owing to its not having the power of keeping the texture and firmneſs, as well as the ſweetneſs of the ſubſtances it is employed to preſerve.

Salt of *Amber* appears by the experiments to be a very powerful antiſeptic ſubſtance, yet I never heard of its being adminiſtered in medicine with this intention, notwithſtanding its antiſeptic powers were diſcovered many years ago by Sir JOHN PRINGLE. It may be ſafely adminiſtered in any putrid complaint, as it has little ſtimulus attending it, is gently diuretic and diaphoretic, may be repeated frequently, is not diſagreeable to the taſte or ſtomach, and takes effect in a moderate doſe; its great price, however, makes it not likely to come into general uſe among the lower ranks of people.

Nitre appears by theſe experiments to have conſiderably ſeptic qualities, which render it improper in diſorders which have any great tendency towards putrefaction. Perhaps this quality may be the cauſe why it ſucceeded ſo ill in the ulcerous ſore throat*, in which diſorder it was obſerved that moſt of thoſe who took Nitre died. This was at that time attributed to its cooling quality and its weakening the force of the circulation, which no doubt were very probable cauſes; but it appears alſo, that Nitre has a poſitive power in promoting a diſpoſition to putrefaction.—It is not however unlikely that the uſe of Nitre in ſome inflammatory fevers, may be owing to this property, as it may promote their criſis by theſe means, in the ſame manner as Sir JOHN PRINGLE ſuppoſed of Chalk and teſtaceous powders. But the uſe of them with ſuch intention, would require great delicacy and judgment, as if they ſhould be puſhed too far, they may produce more dangerous complaints than thoſe they were intended to remedy.

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* I have myſelf ſeen the ulcers in the throat appear much worſe coloured and conſiderably enlarged in a ſhort time, which I could attribute to nothing but the uſe of a Gargle with Nitre.

Borax, though long diſcovered to be a powerful antiſeptic, has not as I know of been ever uſed internally with that intention; and indeed it is very little if at all employed in medicine, the pulv. ad partum of the Edinburgh Diſpenſatory being the only officinal compoſition in which it is retained, and I believe its virtues, in the intention for which it is there employed, are very inſignificant. It ſeems however to promiſe to be more efficacious in putrid diſeaſes, being highly antiſeptic, and not poſſeſſing any qualities that would render it improper in any other reſpect. It has been long uſed externally as a gargle or waſh for young children in the Thruſh, which is probably owing to its antiſeptic quality, and makes it likely that it might very properly be admitted with the ſame intention in the ulcerated ſore throat, on which diſorder the thruſh is very frequently an attendant ſymptom.

Alum, which Sir John Pringle found ſo ſtrongly antiſeptic, appears by theſe expeririments to have but a moderate degree of that quality. This ſhould put us on our guard againſt laying much ſtreſs upon it, ſhould it ever be employed with that intention, at leaſt until its antiſeptic properties be well aſcertained.

The experiment with *Salt* of *Tartar* ſeems to confirm the old opinion, that Alkaline Salts poſſeſſed a degree of a ſeptic quality. Sir John Pringle's experiments indeed ſeem to prove the contrary very ſtrongly; but I believe his experiments were made with the dry ſalt applied to the fleſh, whereas mine was made with a ſolution of it in water, which made the quantity applied much leſs in proportion. Very probably this, like many other ſaline ſubſtances, may be ſeptic in a ſmall quantity, and antiſeptic in a large one. —Although I do not mean to ſet this experiment in contradiction to thoſe of Sir John Pringle, as to the effects of Alkaline Salts in medicine, yet I think it ſhould make us cautious how we employ them in putrid diſeaſes, and give us ſome ſuſpicion that the old opinion of their quality of promoting putrefaction was founded on obſervation and experience.

Volatile Alkaline Salts, contrary to Sir John Pringle's opinion of them, I found powerful promoters of putrefaction, inſtead of having any antiſeptic quality. This was the opinion of Dr. HUXHAM concerning them, relative to their action on the human body, and he gives himſelf a remarkable inſtance of their promoting a putrid habit, in the account of a fever of this kind, which was produced by a cuſtom of taking Volatile Alkaline Salts in large quantity.—Perhaps the ſea ſcurvy may be in ſome meaſure owing to the volatile alkali, produced by putrefaction of the ſhip's proviſions, being taken internally; and it is not unlikely, that the ſame ſubſtance which Dr. HEBERDEN mentions that he had found in ſeveral of the London pump waters, may have ſome ſhare in producing the putrid diſorders to which the lower ranks of people in that city are ſubject. This effect of Alkaline Salts ſhould caution us againſt ſuffering the Alkali to predominate in the Saline mixture. If the ſeaſon of the year is ſuch as Lemons are apt to loſe part of their acidity in, we ſhould make it up by adding a greater quantity of the juice.

THE *Saline Mixture* has been generally eſteemed a powerful antiſeptic, and the more ſo, as taken in the act of effervеſcence, or whilſt the fixible air is retained in the greateſt quantity. Yet in theſe experiments, the Saline Mixture from which the Fixible Air had eſcaped, proved a powerful antiſeptic, whilſt that in which it had been confined, was but very weakly ſo. I cannot aſſign any reaſon for this variation, as the Volatile Saline Mixture which was prepared at the ſame time, and in which the air was confined, proved powerfully antiſeptic. It ſeems however to ſuggeſt that the Fixible Air is not the principal cauſe of the antiſeptic qualities of this preparation.

Camphor and *Myrrh*, which are held by many to be ſo powerfully antiſeptic, appear by theſe experiments to be too inconſiderably ſo to place any dependance on in practice; and the like may be ſaid alſo of the Balſams of Peru and Capivi; the latter indeed ſhewed no inconſiderable antiſeptic quality; but its ſtimulus would render it improper in moſt caſes wherein antiſeptic medicines are indicated.

The antiſeptic quality of *Cinnamon* joined to its moderate yet not inconſiderable aſtringency, and its cordial aromatic virtue, makes me think it would be likely to be one of the beſt remedies in both the putrid, dyſenteric, and in many fevers of that nature which are attended with an increaſed alvine evacuation. The antiſeptic effects of the Peruvian Bark are here fully confirmed; the hot infuſion appears the moſt powerful preparation, perhaps from its containing the greateſt proportion of the reſinous parts, which might be melted out by the heat. For this reaſon we may ſuppoſe the hot infuſion, or decoction of the Peruvian Bark, *preferable in this intention, to the cold infuſion.

Cinnamon united with the Bark does not appear to leſſen its antiſeptic power in the leaſt, and the native vegetable acid, which is a very agreeable addition, appears rather to add to its efficacy in this way.

It ſeems remarkable, that *Brandy* and *Lemon Juice*, which are each of them ſeparately ſo powerful antiſeptics, ſhould, when combined, prove greatly inferior in power to either of them ſingly. This may give us ſome hints relative

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* Dr. Letsom, whoſe ſucceſs in curing putrid diſeaſes with the Peruvian Bark, was more extraordinary than almoſt any other perſon's, almoſt always uſed a hot infuſion or decoction.—*Vide* his excellent Eſſay and Obſervations.

relative to the proper drink of patients in many putrid diſeaſes.

Port Wine and *Madeira* I found fully anſwer the character uſually given of them as antiſeptics; they not only preſerved the ſweetneſs, but the firmneſs of the meat in a high degree, and in this reſpect the Port appeared rather ſuperior to the Madeira.

Red Port Wine is adviſed in putrid fevers, by Dr. HUXHAM, both as the beſt cordial and antiſeptic remedy, the latter of which theſe experiments appear to prove very ſtrongly.

I CANNOT help here mentioning a remark of that excellent writer, which is particularly applicable to diſorders of this kind, viz. that "the dietetic part of medicine is not ſo much ſtudied as it deſerves. It is a more natural way of cure, though indeed leſs pompous than *alexipharmac bolus*, *febrifuge draught*, and *cordial julep*."

Snake-root, by theſe experiments, appears to be far inferior to the character given of it by writers as an antiſeptic. If this account of it be true, we may ſafely omit its uſe in complaints of this kind, as we can eaſily ſubſtitute an aromatic in its place to join with the peruvian bark, viz. *Cinnamon*, which is far more agreeable to the palate and taſte, and ſtrongly antiſeptic in its own nature.

Rhubarb appears by theſe experiments to be a very powerful antiſeptic, and on that account, well adapted to uſe in fevers of a putrid nature, in which ſome evacuation, to carry off any putrid matter that might accumulate in the inteſtines, is frequently neceſſary. The aſtringent quality which it exerts, after its purgative one has ceaſed, renders it in theſe caſes a highly proper medicine, as purgatives in theſe diſorders are very apt to induce great miſchief, operating longer and more ſtrongly than might be expected from the quantity.—Probably for theſe reaſons Rhubarb was uſed by Dr. HUXHAM in this diſorder, and as appears by his account with the beſt effect.

Caſcarilla, which at its firſt introduction was ſaid to poſſeſs extraordinary properties in putrid and malignant caſes,* appears by theſe

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* It was employed in the year 1695, by APINUS, in a petacheal fever, and by Mr. BOULDUC and others, in an epidemic dyſentery in the year 1719, and in both as is ſaid, with good effect,

experiments to be but a very weak antiſeptic. Perhaps its efficacy on the human body may be greater than what it exerted in theſe experiments; but it is probably in this reſpect much inferior to the Peruvian Bark.

Chamomile Flowers appear by theſe experiments to be highly powerful as antiſeptics, but their diſagreeable taſte prevents them coming much into internal uſe in theſe diſeaſes. They ſeem however, from their ſtrong antiſeptic power, the eaſe of their being procured, and their cheapneſs, to be extremely well adapted for external applications with this intention, as fomentations, baths, pediluvia, &c. the uſe of which is very great in ſuch complaints, as †experience has often proved.

I CANNOT help here mentioning an obſervation, tho' not quite applicable to the preſent ſubject, which has frequently occurred to me relative to a medicinal ſubſtance often uſed, and much recommended in many malignant fevers, I mean Muſk. Theſe fevers, it is well known, are often attended with great faintneſs and weakneſs of the nervous ſyſtem, and not infrequently with coma, delirium, and convulſions. In theſe caſes Muſk is frequently directed to allay the nervous ſymptoms, and, as is ſaid, often with good effect; but I think when the putrid ſymptoms run high, that we ſhould be very cautious of adminiſtering it, conſidering that it is an animal ſubſtance, and almoſt always adulterated with half-dried blood, which is well known will putrify very highly, and beſides, generally in a moiſt ſtate and kept in a warm place. I am ſatisfied myſelf, that Muſk itſelf is even in the ſhops often in a degree of putrefaction; but this does not run to any great height, perhaps from ſome antiſeptic virtue of the animal eſſential oil, and ſtill more by the want of ſufficient moiſture to produce the putrefactive fermentation in a high degree. But that Muſk itſelf will putrify, when a ſufficient quantity of water is added, I lately had two inſtances in the experiments which I made in the firſt part of this work, relative to the effect of Fixible Air in diſſolving Muſk.—The two phials, each containing 20 grains of Muſk, and one of them two ounces of common water, and the other two ounces of water impregnated with fixible air, both being left a few days after being examined, in a room of a moderate warmth, putrefied to a high degree, ſo that the ſmell of the putrefaction quite overpowered that of the Muſk.—Probably this putrid ſmell may be in ſome meaſure the cauſe why Muſk is ſo diſagreeable to many, though they are not able to diſtinguiſh it from the ſtrong native odour of the ſubſtance.—May we not then often be throwing a putrid ferment into a body already too much diſpoſed that way, without being aware, and produce the worſt conſequences by it? We all know the bad effect of even a ſmall quantity of animal food, even in its ſweeteſt ſtate in ſuch diſorders, and if taken in a corrupted one, we have every reaſon to think the conſequences would be much worſe. Now we cannot think that the effect would be varied in this caſe merely from the intention with which it was adminiſtered: the quantity indeed is but ſmall, but in ſubſtances that act as ferments, a very ſmall proportion is ſufficient to ſpread the ſame diſpoſition thro' large quantities, and eſpecially if there is any previous tendency that way in the ſubſtances with which it is mixed.—But I do not give this caution merely from theory, I think I have ſeen inſtances of it in practice. I obſerved in three caſes, in each of which large quantities of Muſk were adminiſtered, that two of them, though not originally of a putrid tendency, acquired that diſpoſition very ſtrongly before death, and in all of them the bodies putrefied after death very early, and to a very high degree. Fortunately however, we have it in our power to obtain the good effects of Muſk without danger of its noxious ones. A tincture of Muſk in rectified ſpirits, contains all the aromatic and antiſpaſmodic qualities of the Muſk, while the mere pure animal parts remain undiſſolved and entirely ſeparate. By theſe means we avoid the hazard of introducing a putrid ferment, while we enjoy the benefit at the ſame time of its antipaſmodic virtues. Probably it was with this intention that the Edinburgh college, in the laſt edition of their Pharmacopœia, directed a tincture to be made of Muſk; but whatever was their deſign, the tincture is too weak to anſwer any material intention, being too much limited in doſe by the vehicle, which is rectified Spirits of Wine. Their proportion is only ʒii of Muſk to a pint of rectified ſpirits, being not 4 grs. of Muſk to each half ounce of the Spirit, which is as much of the latter as can well be ſuppoſed to be given at a doſe, but which contains ſo ſmall a quantity of Muſk as to be ſcarce worth regard. Dr. Wall, who had the greateſt ſucceſs with

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† HUXHAM directed antiſeptic fomentations in putrid fevers with great ſucceſs.

Muſk in many caſes, mentions that he never found much effect from it under the doſe of ſix grains, which is conſiderably more than can be here given. But I find by experience that rectified ſpirit will extract the qualities of a much larger proportion of Muſk. I have tried ℥ſs of Muſk with ℥viii of rectified ſpirit, and find it extracts its virtues very compleatly, and I doubt not would do the ſame by a much larger proportion. Half an ounce of the ſpirit contains about 15 grs. of Muſk, and by what I have ſeen of its effects, appears to poſſeſs all the antiſpaſmodic qualities of that quantity of the drug in ſubſtance, with this advantage, which in moſt nervous caſes is a very conſiderable one, that it exerts them much more immediately.

I have thus finiſhed my obſervations for the preſent, but I purpoſe to purſue the ſubject farther, eſpecially relative to antiſeptic ſubſtances. The foregoing experiments and remarks, I am well ſatisfied, are at preſent very defective, but the latter are in every reader's power to judge of as they are drawn from the experiments here deſcribed, which though incomplete in point of the number of objects, were all made with great accuracy and fidelity.

FINIS.